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Part 1 of 3

FOREIGN TECHNOLOGY DIVISION

HANDBOOK ON SPECIAL WORKS
TECHNOLOGICAL LINES OF INDUSTRIAL ENTERPRISES

by

Ye. Ya. Nikolayevskiy

FTD- ID(RS)T-1347-79

UNEDITED MACHINE TRANSLATION

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HANDBOOK ON SPECIAL WORKS. TECHNOLOGICAL LINES OF INDUSTRIAL ENTERPRISES.

By: Ye. Ya. Nikolayevskiy

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

HANDBOOK ON SPECIAL WORKS.

TECHNOLOGICAL LINES OF INDUSTRIAL ENTERPRISES.

Ye. Ya. Nikolayevskiy.

Page 2.

Handbook on special works. Technological conduits/manifolds of industrial enterprises. Ed. 2nd, revised and sup. Edited by Ye. Ya. Nikolayevskiy. M., Stroyizdat, 1972, p. 887 (Minmontazhspetsstroy. State design institute of Giprometallurgmontazh).

Handbook consists of two sections. The first section contains the information about shirts and the parts of conduits/manifolds from different materials - steels of the carbide and alloyed, nonferrous metals and alloys, plastics, with internal anticorrosive coatings, etc.; about reinforcement, supports, suspensions and materials, used in production in the pipeline works. In the second section is given the information about the manufacture of parts and assemblies, the

[Translator's note: Throughout document duct should read tube or pipe; reinforcements should read fittings]

special-purpose assembly of technological conduits/manifolds, including - vacuum, oxygen, high pressure, oil-lubricants and hydraulics, etc.; about testing and putting to use of the assembled communications and shaping of delivery technical documentation.

Special attention is given to the industrial methods of production in the pipeline works. The materials of handbook are considerably renovated and supplemented by the information about changes in the region of technology of manufacture and assembly of technological conduits/manifolds.

Handbook is intended for engineers, technicians, works superintendents, masters and foremen of the construction-assembly organizations, and also for the workers of operational service, who are occupied by manufacture and assembly of the technological conduits/manifolds of industrial enterprises.

Page 3.

Preface.

Successfully accomplished in our country in accordance with directives of XXIV Congress of the Communist Party of the Soviet Union building of enterprises in the most important fields of

industry on the basis of new equipment and advanced technology and occurring basic changes in the technological production processes touched production in the installation works.

Substantial changes occurred in the region of the assembly of technological conduits/manifolds.

The decisive factor of the perfection of technology of the assembly of technological conduits/manifolds is the transfer of maximally possible volume of works from assembling zone into preparing workshops or to plants.

That released into 1964 handbooks on special works the "Technological conduits/manifolds of industrial enterprises" encompassed the wide circle of the questions, connected with manufacture and assembly of technological conduits/manifolds. However, the occured in recent years changes in technology of the assembly of conduits/manifolds required the treatment/processing handbook.

In the second, reworked and enlarged edition, are reflected the new progressive methods of the assembly of conduits/manifolds, and are also given information on organization and production in the works contemporary industrial methods on the basis of advanced

technology.

In the first section of handbook is given the information about shirts and the parts of the conduits/manifolds of different designation/purpose, reinforcement, supports, suspensions and materials.

In the second section of handbook are given to recommendation regarding the organization of the works, connected with the manufacture of units and the assembly of conduits/manifolds by most progressive methods, and also technical requirements, norms and rules, which regulate production in these works. Special attention is given to the industrial method of the blank of tube units, which makes it possible to dismember complex technology of the manufacture of conduits/manifolds to the simple operations, which do not require efficiency of workman, and to establish/install in this case strict control of the quality of works.

The information about weld and special treatment of ducts is given in the volume, necessary in production in the works in the sections, which do not have the narrowly specialized profile/airfoil.

In handbook are used the materials of the number of planning and assembling organizations.

Observations and proposition should be directed to: Moscow, K-31, Kuznetsk bridge, 9, Stroyizdat or it is direct into the design institute of Gipremetallurgmontazh to: Moscow, E-264, 9th park ul, e. 35/36.

Page 4.

First Section.

DUCTS AND PARTS OF THE CONDUITS/MANIFOLDS OF DIFFERENT PURPOSE.

Chapter I.

BASIC INFORMATION ABOUT DUCTS AND CONDUITS/MANIFOLDS.

§ 1. Materials of metallic conduits/manifolds.

1. Steels carbide and alloyed.

Carbon steels of usual quality according to GOST 380-71, supplied with the guaranteed mechanical properties (group A), are marked by letters St. and by ordinal number an increase which indicates an increase in the quantity of carbon in steel, for example St.1, St.2, St.3 and so forth.

Steels, supplied with guarantee by the chemical composition (group B), additionally mark by letter B, for example BSt.1, BSt.2, BSt.3. Steels, supplied with the guaranteed mechanical properties and

to the chemical composition (group C), have in front of a letter V, for example VSt.3, VSt.4 and so forth. To the designations of the trademarks of rimming steel is added the index "kp", semikilled - an index "ps" and killed - an index of "sp" (St.3kp, BSt.4ps, VSt.3sp, etc.), but for the designation of the category of steel is added at the end the number of category, for example St.3ps2, BSt.3kp2, VSt.4ps2.

Carbide fine steel according to GOST 1050-60*, having groups I and II, mark by two-place numerals 05, 08, 10, 15, 20 and so forth showing the average carbon content in one hundredths of a percent. For example, steels of brands 08 and 15 contain respectively on the average of approximately 0.08 and 0.15o/o of carbon. The trademarks of steel with the increased content of manganese are additionally designated by beechnut G (15G, 20G and so forth).

Marking alloy steels (according to GOST 5058-65* and 4543-71) and highly alloyed - according to GOST 5632-61* consists of letterings of the alloying elements, which are contained in this trademark of steel, and the following after them numerals, which indicate the approximate content of this element/cell in percentages, if its quantity exceeds 1.5o/o.

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The numerals before lettering indicate the average carbon content in steel: according to GOST 5058-65* and 4543-71 - in one hundredths of a percent, and according to GOST 5632-61* - in the tenths of percentage. In the trademarks of steels according to GOST 5632-61* numerals in front are not placed, if a quantity of carbon in steel is not limited by low limit with upper limit of 0.09o/o and more; with carbon content to 0.04o/o in front of lettering is placed sign 00; with carbon content from 0.04 to 0.08o/o - sign 0. Letter A at the end of the trademark of steel according to GOST 4543-71 indicates the high quality of steel, while letter Sh - to the especially high quality trademark of steel. For example, high quality chrome-nickel steel 12KhN3A according to GOST 4543-71, which contains about 0.12o/o of carbon, is less than 1.5o/o chromium and about 3o/o of nickel, but letter A indicates the high quality: steel OKh18N12T according to GOST 5632-61* - chrome-nickel-titanium, that contains not more than 0.08o/o carbon, about 18o/o of chromium, about 12o/o of nickel and less than 1.5o/o titanium.

The mechanical properties and the chemical composition of carbon and alloy steels are given in Table 1-9.

(2) Название элемента	(3) Химический символ	(1) Обозначение в марках	
		(4) стали и чугуна	(5) сплавов цветных металлов
(6) Азот	N	А	—
(7) Алюминий	Al	Ю	А
(8) Бор	B	Р	—
(9) Ванадий	V	Ф	—
(10) Вольфрам	W	В	—
(11) Железо	Fe	—	Ж
(12) Кадмий	Cd	—	Кд
(13) Кремний	Si	С	К
(14) Магний	Mg	—	Мг
(15) Марганец	Mn	Г	Мц
(16) Медь	Cu	Д	М
(17) Молибден	Mo	М	—
(18) Никель	Ni	Н	Н
(19) Ниобий	Nb	Б	—
(20) Олово	Sn	—	О
(21) Свинец	Pb	—	С
(22) Селен	Se	Е	—
(23) Серебро	Ag	—	Ср
(24) Титан	Ti	Т	—
(25) Фосфор	P	П	Ф
(26) Хром	Cr	Х	—
(27) Цинк	Zn	—	Ц

Key: (1). Designation in brands/marks. (2). Name of element/cell. (3). Chemical symbol. (4). Steel and pig iron. (5). alloys of nonferrous metals. (6). Nitrogen. (7). Aluminum. (8). Bohr. (9). Vanadium. (10). Tungsten. (11). Iron. (12). Cadmium. (13). Silicon. (14). Magnesium. (15). Manganese. (16). Copper. (17). Molybdenum. (18). Nickel. (19). Niobium. (20). Tin. (21). Lead. (22). Selenium. (23). Silver. (24). Titanium. (25). Phosphorus. (26). Chromium. (27). Zinc.

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Table 1. Mechanical properties of carbon steel (GOST 380-71).

(1) Марка стали	$\sigma_т$	$\sigma_в$	δ_5 (3)
(2)	кгс/мм², не менее		%, не менее
(4) Ст.0	—	31	23
Ст.1сп, Ст.1пс, Ст.1кп (6)	—	31—42	34—35
(5) Ст.2сп, Ст.2пс, Ст.2кп	22—23	33—44	32—33
Ст.3сп, Ст.3пс, Ст.3кп	24—25	37—49	26—27
Ст.4сп, Ст.4пс, Ст.4кп	26—27	41—54	24—25
Ст.5сп, Ст.5пс	29	50—64	20
Ст.6сп, Ст.6пс	32	60	15

Note. Index $\sigma_т$ and δ_5 tney are given for thicknesses to 20 mm.

Key: (1). Trademark of steel. (2). kg/mm², are not less. (3). it is not less. (4). St. (5). St.2sp. (6). St.1kp.

Table 2. The chemical composition of carbon steel in o/o (GOST 380-71).

TABLE 2.

(1) Марка стали	C	Si (2) сталь (4) кп	(5) пс	(6) сп	Mn	P (3) не более	S
(7) БСт.0	Не более 0,23	—	—	—	—	0,07	0,06
(7) БСт.1	0,06—0,12	≤0,05	0,05—0,17	0,12—0,3	0,25—0,5	0,04	0,05
(7) БСт.2	0,09—0,15	≤0,07	0,05—0,17	0,12—0,3	0,25—0,5	0,04	0,05
(8) БСт.3кп		≤0,07	—	—	0,3—0,6		
БСт.3пс (9)	0,14—0,22	—	0,05—0,17	—	0,4—0,65	0,04	0,05
БСт.3сп (10)		—	—	0,12—0,3			
(7) БСт.4	0,18—0,27	≤0,07	0,05—0,17	0,12—0,3	0,4—0,7	0,04	0,05
(7) БСт.5	0,28—0,37	—	0,05—0,17	0,15—0,35	0,5—0,8	0,04	0,05
(7) БСт.6	0,38—0,49	—	0,05—0,17	0,15—0,35			

Note. For the trademarks of steel BSt.1-BSt.6 the content of chromium, nickel and copper must be not more than 0.3o/o, and arsenic - is not more than 0.08o/o.

Key: (1). Trademark of steel. (2). steel. (3). it is not more. (4). KP. (5). ps. (6). sp. (7). BSt. (8). BSt. 3kp. (9). BSt. 3ps. (10). BSt. 3sp.

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Table 3. Mechanical properties of carbon fine steel.

(1) Марка стали	$\sigma_т$	$\sigma_в$	δ_5	ψ	(3) $a_н$, кгс·м/см²
	(2) кгс/мм²		%		
	(4) не менее				
(5) Группа I (ГОСТ 1050—60**)					
08кп (6)	18	30	35	60	—
08	20	33	33	60	—
10кп (6)	19	32	33	55	—
10	21	34	31	55	—
15кп (6)	21	36	29	55	—
15	23	38	27	55	—
20кп (6)	23	39	27	55	—
20	25	42	25	55	—
25	28	46	23	50	9
30	30	50	21	50	8
35	32	54	20	45	7
40	34	58	19	45	6
45	36	61	16	40	5
(5) Группа II (ГОСТ 4543—71)					
15Г	25	42	26	55	—
20Г	28	46	24	50	—
25Г	30	50	22	50	9
30Г	32	55	20	45	8
35Г	34	57	18	45	7
40Г	36	60	17	45	6
45Г	38	63	15	40	5

Key: (1). Trademark of steel. (2). kg/mm². (3). kgf•m/cm². (4). it is not less. (5). Group. (6). KP.

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Table 4. The chemical composition of carbide fine steel in o/o (GOST 1050-60** and GOST 4543-71).

(1) Марка стали	C	Si	Mn	P	S	Cr	Ni
				(2) не более			
(3) Группа I							
08кп (4)	0,05—0,11	(5) До 0,03	0,25—0,5	0,04	0,04	0,1	0,25
08	0,05—0,12	0,17—0,37	0,35—0,65	0,035	0,04	0,1	0,25
10кп (4)	0,07—0,14	(5) До 0,07	0,25—0,5	0,04	0,04	0,15	0,25
10	0,07—0,14	0,17—0,37	0,35—0,65	0,035	0,04	0,15	0,25
15кп (4)	0,12—0,19	(5) До 0,07	0,25—0,5	0,04	0,04	0,25	0,25
15	0,12—0,19	0,17—0,37	0,35—0,65	0,04	0,04	0,25	0,25
20кп (4)	0,17—0,24	(5) До 0,07	0,25—0,5	0,04	0,04	0,25	0,25
20	0,17—0,24	0,17—0,37	0,35—0,65	0,04	0,04	0,25	0,25
25	0,22—0,3	0,17—0,37	0,5—0,8	0,04	0,04	0,25	0,25
30	0,27—0,35	0,17—0,37	0,5—0,8	0,04	0,04	0,25	0,25
35	0,32—0,4	0,17—0,37	0,5—0,8	0,04	0,04	0,25	0,25
40	0,37—0,45	0,17—0,37	0,5—0,8	0,04	0,04	0,25	0,25
45	0,42—0,5	0,17—0,37	0,5—0,8	0,04	0,04	0,25	0,25
(3) Группа II (ГОСТ 4543—71)							
15Г	0,12—0,19	0,17—0,37	0,7—1	0,035	0,035	0,3	0,3
20Г	0,17—0,24	0,17—0,37	0,7—1	0,035	0,035	0,3	0,3
25Г	0,22—0,3	0,17—0,37	0,7—1	0,035	0,035	0,3	0,3
30Г	0,27—0,35	0,17—0,37	0,7—1	0,036	0,036	0,3	0,3
35Г	0,32—0,4	0,17—0,37	0,7—1	0,035	0,035	0,3	0,3
40Г	0,37—0,45	0,17—0,37	0,7—1	0,035	0,035	0,3	0,3
45Г	0,42—0,5	0,17—0,37	0,7—1	0,035	0,035	0,3	0,3

Key: (1). Trademark of steel. (2). it is not more. (3). Group. (4). KP. (5). Up to.

Table 5. Mechanical properties of low-alloy structural steels (GOST 5058-65*).

TABLE 5.

(1) Марка стали	$\sigma_в$	$\sigma_т$	δ_5, %	(3) $a_н$, кгс·м/см²
	(2) кгс/мм²			
	(4) не менее			
14ХГС	50	35	22	4
15ХСНД	50	35	21	3
14Г	46	29	21	3,5
19Г	48	32	22	3,5
09Г2	45	31	21	3
14Г2	47	34	21	3,5
10Г2С1	52	38	21	4

Key: (1). Trademark of steel. (2). kg/mm². (3). kgf•m/cm². (4). it is not less.

Table 6. The chemical composition of low-alloy structural steels in o/o (GOST 5058-65*).

(1) Марка стали	C	Si	Mn	Cr	Ni	Cu
14ХГС	0,11—0,16	0,4—0,7	0,9—1,3	0,5—0,8	0,3	0,3
15ХСНД	0,12—0,18	0,4—0,7	0,4—0,7	0,6—0,9	0,3—0,6	0,2—0,4
14Г	0,12—0,18	0,17—0,37	0,7—1	0,3	0,3	0,3
19Г	0,16—0,22	0,17—0,37	0,8—1,15	0,3	0,3	0,3
09Г2	<0,12	0,17—0,37	1,4—1,8	0,3	0,3	0,3
14Г2	0,12—0,18	0,17—0,37	1,2—1,6	0,3	0,3	0,3
10Г2С1	<0,12	0,9—1,2	1,3—1,65	0,3	0,3	0,3

Note. The content of phosphorus must be not more than 0.035o/o and sulfur not more than 0.04o/o.

Page 9.

2. Steels highly alloyed.

High-alloyed corrosion-resistant, high-temperature (oxidation-resistant) and high-temperature (strength) steels are intended for a work under conditions, which require high heat resistance and resistance to corrosion.

The chemical composition and the density of steels with the delivery of ducts are given in Table 10.

Table 7. Mechanical properties of alloy structural steels (GOST 4543-71).

(1) Марка стали	(2) Твердость в отожженном или отпущенном состоянии HB: (5) диаметр отпечатка в мм, не менее	(6) число твердости, не более	$\sigma_в$	$\sigma_т$	δ_5	ψ	(4) $a_н$, кгс·м/см²
			(3) кгс/мм²		%		
			(7) не менее				
15Х	4,5	179	70	50	12	45	7
20Х	4,5	179	80	65	11	40	6
30Х	4,4	187	90	70	12	45	7
35Х	4,3	197	95	75	11	45	7
38ХА	4,2	207	95	80	12	50	9
40Х	4,1	217	100	80	10	45	6
10Г2	4,3	197	43	25	22	50	—
18ХГ	4,4	187	90	75	10	40	—
40ХГТР	4	229	100	80	11	45	8
35ХГФ	4,2	207	93	80	14	55	8
15ХМ	4,5	179	45	28	21	55	12
30ХМ	4	229	95	75	11	45	8
30ХМА	4	229	95	75	12	50	9
35ХМ	3,9	241	95	85	12	45	8
15ХФ	4,4	187	75	55	13	50	8
40ХФА	3,9	241	90	75	10	50	9
12ХН2	4,2	207	80	60	12	50	9
30ХГСА	4	229	110	85	10	45	5
35ХГСА	3,9	241	165	130	9	40	4

Key: (1). Trademark of steel. (2). Hardness in annealed or tempered state HB. (3). kg/mm². (4). kgf•m/cm². (5). diameter of impression in mm, is not less. (6). hardness number, is not more. (7). it is not less.

Table 8. The content of phosphorus, sulfur, coppers, nickel and chromium in alloy structural steels in o/o, are not more (GOST 4543-71).

TABLE 8.

(1) Категория стали	P	S	Cu	Ni	Cr
(2) Качественная	0,035	0,035	0,30	0,30	0,30
(3) Высококачественная . . .	0,025	0,025	0,30	0,30	0,30
(4) Особо высококачественная	0,025	0,015	0,25	0,30	0,30

Key: (1). Category of steel. (2). Good-quality. (3). High quality. (4). Especially high quality.

Page 10.

Table 9. The chemical composition of alloy structural steels in o/o (GOST 4543-71).

(1) Группа стали	(2) Марка стали	C	Si	Mn	Cr	(3) Прочие элементы
(4) Хромистая	15X	0,12—0,18	0,17—0,37	0,4—0,7	0,7—1	—
	20X	0,17—0,23	0,17—0,37	0,5—0,8	0,7—1	—
	30X	0,24—0,32	0,17—0,37	0,5—0,8	0,8—1,1	—
	35X	0,31—0,39	0,17—0,37	0,5—0,8	0,8—1,1	—
	38XA	0,35—0,42	0,17—0,37	0,5—0,8	0,8—1,1	—
	40X	0,36—0,44	0,17—0,37	0,5—0,8	0,8—1,1	—
(5) Марганцовистая	10Г2	0,07—0,15	0,17—0,37	1,2—1,6	—	—
(6) Хромомарганцовая	18XГ	0,15—0,21	0,17—0,37	0,9—1,2	0,9—1,2	—
	40XГТР	0,38—0,45	0,17—0,37	0,7—1,0	0,8—1,1	Ti 0,03—0,09
	35XГФ	0,31—0,38	0,17—0,37	0,95—1,25	1,0—1,3	V 0,06—0,12
(7) Хромомолибденовая	15XM	0,11—0,18	0,17—0,37	0,4—0,7	0,8—1,1	Mo 0,4—0,55
	30XM	0,26—0,34	0,17—0,37	0,4—0,7	0,8—1,1	Mo 0,15—0,25
	30XMA	0,26—0,33	0,17—0,37	0,4—0,7	0,8—1,1	Mo 0,15—0,25
	35XM	0,32—0,4	0,17—0,37	0,4—0,7	0,8—1,1	Mo 0,15—0,25
(8) Хромованадиевая	15XФ	0,12—0,18	0,17—0,37	0,4—0,7	0,8—1,1	V 0,06—0,12
	40XФA	0,37—0,44	0,17—0,37	0,5—0,8	0,8—1,1	V 0,1—0,18
(9) Хромоникелевая	12XH2	0,09—0,16	0,17—0,37	0,3—0,6	0,6—0,9	Ni 1,5—1,9
(10) Хромокремнемарганцовая	30XГСА	0,28—0,34	0,9—1,2	0,8—1,1	0,8—1,1	—
	35XГСА	0,32—0,39	1,1—1,4	0,8—1,1	1,1—1,4	—

Key: (1). Group of steel. (2). Trademark of steel. (3). Other elements/cells. (4). Chromic. (5). Manganous. (6). Chrome-manganese. (7). Chromiummolybdenum. (8). Chromovanadium. (9). Chrome-nickel. (10). Chrome-silicon manganese.

Pages 11-15. Table 10. The chemical composition of high-alloy steels in o/o.

(1) Марка стали	(2) Прежние обозначения марок сталей	C	Si	Mn	Cr	Ni	(8) Прочие элементы	S	P	(11) Плотность стали γ
								(10) не более		
ГОСТ 5632—61*										
Х5	—	(5) До 0,15	(5) До 0,5	(5) До 0,5	4,5—6	—	—	0,025	0,03	7,85
Х5М	ЭХ5М	» 0,15	» 0,5	» 0,5	4,5—6	—	Mo 0,45—0,6	0,025	0,03	7,85
Х5ВФ	—	» 0,15	0,3—0,6	» 0,5	4,5—6	—	W 0,4—0,7 V 0,4—0,6	0,025	0,03	7,85
1Х13	ЭЖ1	0,09—0,15	(5) До 0,6	» 0,6	12—14	—	—	0,025	0,03	7,7
0Х13	ЭИ496	(5) До 0,08	» 0,6	» 0,6	11—13	—	—	0,025	0,03	7,7
Х17	ЭЖ17	» 0,12	» 0,8	» 0,7	16—18	—	—	0,025	0,035	7,7
0Х17Т	ЭИ645	» 0,08	» 0,8	» 0,7	16—18	—	Ti 5.C—0,8	0,025	0,035	7,7
Х25Т	ЭИ439	» 0,15	» 1	» 0,8	24—27	—	Ti 5.C—0,8	0,025	0,035	7,6
Х28	ЭЖ27 ЭИ349	» 0,15	» 1	» 0,8	27—30	—	—	0,025	0,035	7,6
0Х20Н14С2	ЭИ732	» 0,08	2—3	» 1,5	19—22	12—15	—	0,025	0,035	7,7
0Х22Н5Т	ЭИ53 (0Х21Н5Т)	» 0,08	(5) До 0,8	» 0,8	21—23	5,3—6,3	Ti 0,3—0,6	0,025	0,035	7,6
1Х21Н5Т	ЭИ811	0,09—0,14	(5) До 0,8	(5) До 0,8	20—22	4,8—5,8	Ti 0,25—0,5	0,025	0,035	7,6
1Х14Н18В2БР	ЭИ695Р	0,07—0,12	» 0,6	1—2	13—15	18—20	B до 0,005 W 2—2,75; Nb 0,9—1,3 Ce до 0,02	0,02	0,035	8,15
Х17Н13М2Т	(Х18Н12М2Т) ЭИ448	(5) До 0,1	(5) До 0,8	1—2	16—18	12—14	Ti 0,3—0,6 Mo 1,8—2,5	0,02	0,035	8
Х17Н13М3Т	ЭИ432	» 0,1	» 0,8	1—2	16—18	12—14	Ti 0,3—0,6 Mo 3—4	0,02	0,035	8
0Х17Н16М3Т	ЭИ580	» 0,08	» 0,8	1—2	16—18	15—17	Ti 0,3—0,6 Mo 3—3,5	0,02	0,035	8,1
00Х18Н10	ЭИ842	» 0,04	» 0,8	1—2	17—19	9—11	—	0,02	0,035	7,9
0Х18Н10	ЭЯ0 (0Х18Н9)	» 0,08	» 0,8	1—2	17—19	9—11	—	0,02	0,035	7,9
Х18Н9	ЭЯ1 (1Х18Н9)	» 0,12	» 0,8	1—2	17—19	8—10	—	0,02	0,035	7,9
2Х18Н9	ЭЯ2	0,13—0,21	» 0,8	1—2	17—19	8—10	—	0,02	0,035	7,9
0Х18Н10Т	ЭИ914	(5) До 0,08	» 0,8	1—2	17—19	9—11	Ti 5.C — 0,6	0,02	0,035	7,9

Марка стали	Прежние обозначения марок сталей	C	Si	Mn	Cr	Ni	Прочие элементы	S (не более)	P (не более)	Плотность стали γ
Х18Н10Т	ЭЯ1Т (1Х18Н9Т)	До 0,12	До 0,8	1—2	17—19	9—11	Ti 5.(C — 0,02)—0,7	0,02	0,035	7,9
0Х18Н12Т	—	» 0,08	» 0,8	1—2	17—19	11—13	Ti 5.C—0,6	0,02	0,035	7,95
Х18Н12Т	—	» 0,12	» 0,8	1—2	17—19	11—13	Ti 5.(C — 0,02)—0,7	0,02	0,035	7,95
0Х18Н12Б	ЭИ402 (Х18Н11Б)	» 0,08	» 0,8	1—2	17—19	11—13	Nb 8.C—1,2	0,02	0,035	7,9
0Х23Н18	—	» 0,1	» 1	До 2	22—25	17—20	—	0,02	0,035	7,95
Х23Н18	ЭИ417	» 0,2	» 1	» 2	22—25	17—20	—	0,02	0,035	7,95
0Х23Н28М2Т	ЭИ628	» 0,06	» 0,8	» 0,8	22—25	26—29	Ti 0,4—0,7 Mo 1,8—2,5	0,02	0,035	7,95
0Х23Н28М3Д3Т	ЭИ943	» 0,06	» 0,8	» 0,8	22—25	26—29	Ti 0,5—0,9 Mo 2,5—3 Cu 2,5—3,5	0,02	0,035	7,96
Х25Н20С2	ЭИ283	» 0,2	2—3	» 1,5	24—27	18—21	—	0,02	0,035	7,7
ГОСТ 10493—63										
Х3МВ	—	0,15—0,2	<0,4	0,25—0,5	2,5—3	<0,25	Mo 0,5—0,7 W 0,5—0,8 V 0,05	0,03	0,03	—
ГОСТ 10498—63										
0Х18Н10Т	ЭИ914	0,04—0,06	До 0,8	1—2	17—19	9—11	Ti 5.C—0,6	0,02	0,035	7,9
1Х18Н10Т	ЭЯ1Т	0,07—0,1	» 0,8	1—2	17—19	9—11	Ti 5.C—0,8	0,02	0,035	7,9
1Х13С2М2	ЭИ852	0,1—0,15	1,4—2,1	До 0,6	12—14	До 0,3	Mo 1,2—2	0,02	0,03	—
0Х16Н15М3	ЭИ844	До 0,03	До 0,8	» 0,8	14—17	14—16	Mo 2,5—3,5	0,02	0,03	—
1Х16Н15М3Б	ЭИ847	0,04—0,08	» 0,4	» 0,8	15—17	14—16	Mo 2,7—3,3 Nb 0,4—0,9	0,015	0,025	—
00Х16Н15М3Б	ЭИ844Б	До 0,04	» 0,6	» 0,8	15—17	14—16	Mo 2,5—3 Nb 0,4—0,6	0,02	0,035	—
ГОСТ 10500—63										
12МХ	—	0,09—0,16	0,015—0,3	0,4—0,7	0,4—0,6	<0,25	Mo 0,4—0,6	0,025	0,03	—
12Х1МФ	12ХМФ	0,08—0,15	0,17—0,37	0,4—0,7	0,9—1,2	<0,25	Mo 0,25—0,35 V 0,15—0,3	0,025	0,03	—
2[illegible]Х1МФ	ЭИ10	0,22—0,29	0,17—0,37	0,4—0,7	1,5—1,8	<0,25	Mo 0,25—0,35 V 0,15—0,3	0,025	0,03	—

1 Марка стали	2 Прежние обозначения марок сталей	C	Si	Mn	Cr	Ni	3 Прочие элементы	S	P	4 Плотность сталей γ
								4a не более		
25Х2М1Ф	ЭИ723	0,22—0,29	0,17—0,37	0,4—0,7	2,1—2,6	<0,25	Mo 0,9—1,1 V 0,3—0,5	0,025	0,03	—
18Х3МВ	ЭИ578, Н8	0,15—0,2	0,17—0,37	0,25—0,5	2,5—3	<0,25	W 0,5—0,8 Mo 0,5—0,7 V 0,05—0,15	0,025	0,03	—
20Х3МВФ	ЭИ415, ЭИ579	0,16—0,24	0,17—0,37	0,25—0,5	2,8—3,3	<0,25	W 0,3—0,5 Mo 0,35—0,55 V 0,6—0,85	0,025	0,03	—
				ГОСТ 11068—64						
00Х18Н10Т	—	5 До 0,04	До 0,8	1—2	17—19	9—11	Ti 5.C—0,4	0,02	0,035	7,9

Notes: 1. The content of sulfur in the ducts, which are subject to weld and supplied according to GOST 9940-72 and 9941-72, must not exceed 0.02o/o.

2. For ducts according to GOST 10498-63 of steel of brand/mark 1Kh16N15MZB (EI847) ratio of niobium to carbon (Nb/C) must be in limits of 9-13; are allowed/assumed deviation of niobium +0.2o/o, of carbon +0.01o/o, of silicon +0.1o/o and lowering ratio Nb/C to 8.

3. For ducts, supplied according to GOST 11068-64, carbon content in steel of brands/marks Kh18N10T and Kh18N12T must not exceed 0.1o/o and content of sulfur in steel of brands/marks 0Kh22N5T (0Kh21N5T) and 1Kh21N5T must be not more than 0.02o/o.

4. Mechanical properties of high-alloy steel with delivery of ducts are given in Tables 11, 14, 16 and 20 chapters II.

Key: (1). Trademark of steel. (2). Previous designations of trademarks of steels. (3). Other elements/cells. (4). Steel density. (4a). it is not more. (5). Up to.

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3. Pig irons.

Gray cast iron contains 2.5-3.7o/o of carbon and 0.5-3o/o of silicon, has in break gray color.

The mechanical properties of cast iron indicate in the marking (GOST 1412-70), in which after literal designation SCh (gray cast iron) are written two numbers, which show (in kg/mm^2) tensile figure and transverse strength, for example SCh24-44, SCh15-32 and so forth.

Malleable cast iron obtains as a result of the annealing (blistering) of white iron, thanks to which considerably are liquefied brittleness and hardness of the latter. Castings from ductile cast iron are marked according to GOST 1215-59, moreover after letters KCh (malleable cast iron) they give two numbers which indicate tensile figure (it is not less) in kg/mm^2 and elongation per unit length in o/o, for example KCh37-12, KCh33-8, etc. From malleable cast iron prepare shaped pieces to steel tubes and some types the reinforcements.

High-chromium pig irons contain 26-36o/o of chromium, they possess high chemical resistance in oxidative media and acids (with exception of hydrochloric acid), are resisted well mechanical wear. High-chromium pig irons use for manufacturing of ducts, shaped parts

and reinforcement for the conduits/manifolds, which transport highly oxidizing products.

High-chromium pig irons mark by letter Kh and by the two-place numeral, which indicates the average content of chromium in o/o. The information about the chemical composition and the mechanical properties of some brands/marks of high-chromium cast irons is given in Table 11.

High-silica pig irons (ferrosilide and antichlor) contain 14.5-18o/o silicon. In the composition of antichlor enters also molybdenum (3.5-4o/o), which raises the resistance of pig iron against the effect of hydrochloric acid.

High-silica pig irons use for manufacturing of ducts, shaped parts and reinforcement, intended for the conduits/manifolds, which transport different corrosion-active chemical products.

Articles made of ferrosilide and antichlor obtain only by casting. The machining of articles in view of their large hardness is hindered/hampered.

Table 11. The chemical composition in o/o and the mechanical properties of castings from high-chromium pig iron (GOST 2176-67).

(1) Марка чугуна	C	Cr	Si	Mn	Ni	Cu	S	P	$\sigma_в$	$\sigma_и$	(4) Твердость по Бринеллю HB
					(2) не более				(3) кгс/мм², не менее		
75Х28Л	0,5—1	26—30	0,5—1,3	0,5—0,8	0,5	0,3	0,08	0,1	35	55	220—270
185Х34Л	1,5—2,2	32—36	1,3—1,7	0,5—0,8	0,5	0,3	0,1	0,1	40	60	280—330

Key: (1). Brand/mark of pig iron. (2). it is not more. (3). kg/mm², are not less. (4). Hardness according to Brinell HB.

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Data about the chemical composition, mechanical properties and chemical resistance of castings from ferrosilide and antichlor are given in Table 12.

4. Nonferrous metals and alloys (Table 13-17).

Nonferrous metals and alloys: aluminum, copper brass, bronze, lead - use for manufacturing of ducts, reinforcement, adapters and plies of flange joints.

At elevated temperatures the mechanical properties of nonferrous metals descend; therefore their use/application for manufacturing the parts of conduits/manifolds, which work under pressure, usually are limited by the following temperature limits:

Copper, bronze, brass ... to 250°C.

Aluminum ... to 150°C.

Lead ... to 140°C.

Table 12. The chemical composition in o/o and the mechanical properties of castings from ferrosilide and antichlor (GOST 2233-70).

(1) Марка чугуна	C	Si	Mn	Mo	P (2) не более	S (2) не более	(3) $\sigma_и$, кгс/мм²	(4) Твердость по Бринеллю HB
			(5) Ферросилид					
C15	0,3—0,8	14,5—16	0,3—0,8	—	0,1	0,07	17	300—400
C17	0,3—0,5	16—18	0,3—0,8	—	0,1	0,07	14	400—460
			(6) Антихлор					
C15M4	0,5—0,6	14,5—16	0,3—0,5	3,5—4	0,1	0,1	14	400—450

Key: (1). Brand/mark of pig iron. (2). it is not more. (3). kg/mm². (4). Hardness according to Brinell HB. (5). Ferrosilide. (6). Antichlor.

Table 13. The chemical composition in o/o (GOST 859-66) and the mechanical properties of copper (GOST 617-64*) in finished articles.

(1) Марка меди	(2) Cu, не менее	(3) Примеси, не более	(4) $\sigma_в$, кгс/мм² (5) не менее	δ, % (5) не менее
M1	99,9	0,1	$\frac{21}{19}$	$\frac{35}{30}$
M2	99,7	0,3		
M3	99,5	0,5		
M3р	99,5	0,5		

Note. The mechanical properties of copper are given in numerator for the ducts of pulled ones or cold-rolled (M), and in denominator - for pressure forging.

Key: (1). Brand/mark of copper. (2). it is not less. (3). Admixtures/impurities, are not more. (4). kg/mm².

Pages 18-19. Table 14. The chemical composition in o/o (GOST 4784-65*) and the mechanical properties of aluminum and aluminum alloys (GOST 4773-65).

(1) Марка алюминия и сплава	Cu	Mg	Mn	Si	Al	(2) Примесей, не более	(3) $\sigma_в$, кгс/мм²	δ, % (4) не менее
АД00	—	—	—	—	(4) Не менее 99,7	0,3	(4) Не менее 6	20
АД0	—	—	—	—	(4) Не менее 99,5	0,5	(4) Не менее 6	20
АД1	—	—	—	—	(4) Не менее 99,3	0,7	6—11	20
АД	—	—	—	—	(4) Не менее 98,8	1,2	6—11	20
Д1	3,8—4,8	0,4—0,8	0,4—0,8	—	(5) Основа	2	(4) Не более 25 / 36—38	10 / 10—12
Д16	3,8—4,9	1,2—1,8	0,3—0,9	—	»	1,6	(4) Не более 25 / 40—43	10 / 10—12
АВ	0,1—0,5	0,45—0,9	0,15—0,35	0,5—1,2	»	0,95	(4) Не более 15 / 21—31	17 / 8—14
АМц	—	—	1—1,6	—	»	1,95	9—14 / 10—17	—
АМг2	—	1,8—2,8	0,2—0,6	—	»	1,3	16—22	—
АМг3	—	3,2—3,8	0,3—0,6	0,5—0,8	(5) Основа	1	(4) Не менее 19 / Не менее 18 (4)	15
АМг5	—	4,8—5,8	0,5—0,8	—	»	1,4	(4) Не менее 27 / Не менее 26 (4)	15
АМг6	—	5,8—6,8	0,5—0,8	—	»	1,2	(4) Не менее 32	15
АК6	1,8—2,6	0,4—0,8	0,4—0,8	0,7—1,2	»	1,3	29—38	8—10
В95	1,4—2	1,8—2,8	0,2—0,6	—	»	1,2	50—52	5—7
АВД1-1	2,5—3,5	0,2—0,7	<0,7	—	»	1,2	—	—

Notes: 1. In alloy AV manganese can be replaced by chromium in

the same quantities.

2. Into alloys AMg5 and AMg6 enter also: titanium 0.02-0.1o/o beryllium 0.0002-0.005o/o.

3. Alloy V95 contains also zinc 5-7o/o and chromium 0.1-0.25o/o.

4. Mechanical properties of brands/marks of alloys AK6 and V95 are given according to GOST 11535-65.

5. Chemical composition of alloy AVD1-1 is given according to GOST 1131-67.

6. Mechanical properties of aluminum alloys in numerator are given for pulled ducts according to GOST 4773-65, and in denominator - for those pressed according to GOST 11535-65.

Key: (1). Brands/marks of aluminum and alloy. (2). Admixtures/impurities, it is not more. (3). kg/mm². (4). it is not less. (5). Basis.

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Table 15. The chemical composition in o/o (GOST 15527-70) and the mechanical properties of brasses.

(1) Марка латуни	Cu	Pb	Fe	Mn	Al	Sn	As	Zn	(2) Примеси, не более	(3) $\sigma_в$, кгс/мм²	δ_{10}, %
										(4) не менее	
Л96	95—97	—	—	—	—	—	—	(5) Остальное	0,2	(6) По ГОСТ 11383—65	
										21	35
										(6) По ГОСТ 494—69	
Л68	67—70	—	—	—	—	—	—	»	0,3	30	38
Л63	62—65	—	—	—	—	—	—	»	0,5	30	38
Л60	59—62	—	—	—	—	—	—	»	1	35	20
ЛА77-2	76—79	—	—	—	1,75—2,5	—	—	»	0,3	30	23
ЛОМШ 70-1-0,05	69—71	—	—	—	—	1—1,5	0,025—0,06	»	0,3	30	38
ЛМШ68-0,05	67—70	—	—	—	—	—	0,025—0,06	»	0,3	30	38
ЛО70-1	69—71	—	—	—	—	1—1,5	—	»	0,3	30	38
ЛС59-1	57—60	0,8—1,9	—	—	—	—	—	»	0,75	40	20
ЛАМШ77-2-0,05	76—79	—	—	—	1,75—2,5	—	0,025—0,06	»	0,3	30	23
ЛЖМц59-1-1	57—60	—	0,6—1,2	0,5—0,8	0,1—0,4	0,3—0,7	—	»	0,25	44	28

Note. The mechanical properties of brasses of brands L60, LS59-1 and LZhMts59-1-1 are given for the pressed ducts, remaining brands/marks - for pulled soft ones.

Key: (1). Brand/mark of brass. (2). Admixtures/impurities, are not more. (3). kg/mm². (4). it is not less. (5). Remaining. (6). On.

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§ 2. Testing metals and ducts.

1. Tensile test.

During testing is determined the tensile strength and plasticity of metal, for which the samples/specimens clamp between the sponges/jaws of tension grips and dilate/extend them under the effect/action of uninterrupted and gradually applied load.

Form and sizes/dimensions of samples/specimens for tensile test are established/installed by GOST 1497-61. In accordance with the standard indicated are prepared the short and long cylindrical and flat/plane samples/specimens of different types, moreover the use/application of short samples/specimens is more preferable.

Normal cylindrical samples/specimens receive the diameter of d_0=10 mm. Initial calculated length of the cylindrical samples/specimens: short $l_0=5\ d_0$, long $l_0=10\ d_0$.

The initial calculated length of the flat/plane samples/specimens: short $l_0=5.65\ \sqrt{F_0}$; long $l_0=11.3\ \sqrt{F_0}$ where F_0 - initial area of cross section/cut of sample/specimen.

Relationships/ratios $l_0=5.65\sqrt{F_0}$ and $l_0=11.3\sqrt{F_0}$ are equivalent to relationships/ratios $l_0=5\ d_0$ and $l_0=10\ d_0$.

The basic dimensions of the most frequently used cylindrical (type III) and flat/plane (type I) samples/specimens for testing are shown in Tables 18, 19.

Table 16. Chemical composition in % (GOST 493-54*) and mechanical properties (GOST 1208-54) of tin-free bronzes.

(1) Марка бронзы	Al	Fe	Mn	Ni	Cu	(2) Примеси, не более	$\sigma_в$, (3) кгс/мм²	δ, %
							(4) не менее	
Бр. АЖМц 10-3-1,5	9—11	2—4	1—2	—	(5) Остальное	0,75	60	12
Бр. АЖН 10-4-4	9,5—11	3,5—5,5	—	3,5—5,5	»	0,8	65	5

Key: (1). Brand of bronze. (2). Impurities, not more than. (3). kg/mm². (4). Not less than. (5). Remainder.

Table 17. Chemical composition of lead in % (GOST 3778-65*).

(1) Состав	(2) Марка свинца			
	C0	C1	C2	C3
(3) Pb, не менее	99,992	99,985	99,95	99,9
(4) Примеси, не более	0,008	0,015	0,05	0,1

Key: (1). Composition. (2). Brand of lead. (3). Pb, not less than. (4). Impurities, not more than.

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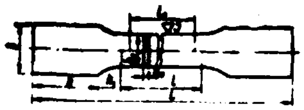
Table 18. Sizes/dimensions of proportional cylindrical samples/specimens in mm (type III) (GOST [All-union State Standard] 1497-61).

d_0	D	h^*	h_1	R	(1) Короткий образец $l_0 = 5d_0$			(2) Длинный образец $l_0 = 10d_0$		
					(3) № образца	l_0	l	(3) № образца	l_0	l
25	45	30	5	5	12к	125	150	12	250	275
20	34	25	5	5	13к	100	120	13	200	220
15	28	20	3	3	14к	75	90	14	150	165
10	16	10	3	3	15к	50	60	15	100	110
8	13	10	3	2	16к	40	48	16	80	88
6	12	10	2,5	1,5	17к	30	36	17	60	66
5	11	10	2,5	1,5	18к	25	30	18	50	55
4	9	8	2,5	1,5	19к	20	24	19	40	44
3	7	7	2	1,5	20к	15	18	20	30	33

Key: (1). Short sample/specimen. (2). Long sample/specimen. (3). sample/specimen.

FOOTNOTE [1]. The length of head h is shown minimum. ENDFOOTNOTE.

Table 19. Sizes/dimensions of flat/plane samples/specimens in mm with head (type I) (GOST 1497-61).



a_0	b_0	B	h*	(1) Короткий образец $l_0 = 5{,}65\sqrt{F_0}$			(2) Длинный образец $l_0 = 11{,}3\sqrt{F_0}$		
				(3) № образца	l_0	l	(3) № образца	l_0	l
25	30	40	100	49к	155	170	49	310	325
20	30	40	80	54к	140	155	54	280	295
16	30	40	80	58к	125	140	58	250	265
12	30	40	60	62к	105	120	62	210	225
10	30	40	60	64к	100	115	64	200	215
8	30	40	50	66к	85	100	66	170	185
6	30	40	50	68к	75	90	68	150	165
4	30	40	50	70к	60	75	70	120	135
3	20	30	40	71к	45	55	71	90	100
2	20	30	40	72к	35	45	72	70	80

Key: (1). Short sample/specimen. (2). Long sample/specimen. (3). sample/specimen.

FOOTNOTE [1]. The length of head h is shown minimum, h_1=20-25 mm. ENDFOOTNOTE.

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For the material testing of ducts for stretchings (GOST 10006-62) are cut out longitudinal and cross samples/specimens. Longitudinal specimens prepare in the form:

a) the cut of the duct of total cross section for ducts in diameter from 18 to 50 mm inclusively;

b) the strip, cut out along the axis/axle of duct, with the width of the working part:

when $D_н$ from 18 to 30 mm ..., 8 mm.

when $D_н$ is more than 30 to 50 mm .... 10 mm.

when $D_н$ it is more than 50 mm ... 12 mm.

c) the cylinders with a diameter of 5 mm with the wall thickness of duct from 7 to 13 mm inclusively and by the diameter of 10 mm with wall thickness are more than 13 mm.

Samples/specimens are prepared in accordance with requirements GOST 1497-61.

Cross samples/specimens prepare by the cylindrical proportional, cut out from body ducts perpendicular to its longitudinal axis.

The diameter of sample/specimen d depending on the diameter of pipe $D_н$ and thickness of its wall S select in accordance with data of Table 20.

2. Hardness test.

By hardness is understood the property of material to be resisted the penetration in it of another, more solid, which does not obtain in this case residual deformations.

For hardness test most frequently use two basic methods the measurements - according to Brinell and according to Rockwell.

Hardness according to Brinell is determined on stationary or portable apparatuses, and also by Poldi hardness tester.

In the measurement of hardness according to Brinell (GOST 9012-59) the steel ball of the established/installed diameter D (10 either 5 or 2.5 mm) is imprinted into test specimen (article) under the pressure of load P of that applied during the specific time; after the removal/distance of load is measured the diameter of impression d, which remained on ~~(illeg)~~ the surface of the sample/specimen.

Table 20. Data for the selection of the diameter of cross sample/specimen depending on the diameters of duct and of its wall thickness.

(1) Размеры в мм		
$D_н$	S	d
(2) От 120 (3) до 160	14 (4) и более	3
» 160 » 250	20 »	5
» 250 » 290	17 »	5
» 220 » 280	32 »	10
» 280 » 320	26 »	10
(5) Более 320	24 »	10

Key: (1). Sizes/dimensions in mm. (2). From. (3). to. (4). and more. (5). It is more.

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The hardness number according to Brinell, designated HB, is quotient of the division of load on the surface area of indentation cup and is determined from the formula

$$HB = \frac{P}{F} = \frac{2P}{\pi D\left(D - \sqrt{D^2 - d^2}\right)}, \qquad (1)$$

where P - load in kg; F - surface area of impression in the mm²; D - diameter of ball/sphere in mm; d - diameter of impression in mm.

In GOST 9012-59 is given the table for determining the hardness number according to Brinell in dependence on the diameter of

ball/sphere, diameter of impression and applied load.

The diameters of ball/sphere D, loads P and duration of holding under load t select depending on material and thickness of test specimen in accordance with data of Table 21.

Rockwell hardness (GOST 9013-59) is measured via depression into the surface of the control sample/specimen of standard type special tip (steel ball or diamond cone) under the effect/action of two consecutively/serially accompanying loads.

Rockwell hardness is measured in arbitrary units depending on the depth of insertion of tip into the surface of article (sample/specimen) and is determined directly from indicator on dial face.

Hardness number on rockwells is determined by three scales - A, B, C and designate HR with the addition of the index of scale and numerical value of the quantity of hardness according to this scale; for example HRB 80 (hardness 80 according to the scale B).

Table 21. Data for the selection of the diameter of ball/sphere, loads and duration of the holding under it of control sample/specimen on Brinell's press.

(1) Наименование металла	(2) Интервал твердости в числах Бринелля	(3) Размеры в мм S	D	(4) P, кгс	(5) t, сек
(6) Сталь и чугун	140—150	6-3 4-2 (7) Менее 2	10 5 2,5	$30D^2$	10
	<140	(8) Более 6 6-3 (7) Менее 3	10 5 2,5	$10D^2$	
(9) Цветные металлы и сплавы	>130	6-3 4-2 (7) Менее 2	10 5 2,5	$30D^2$	30
	35—130	9-3 6-3 (7) Менее 3	10 5 2,5	$10D^2$	30
	8—35	(8) Более 6 6-3 (7) Менее 3	10 5 2,5	$2,5D^2$	60

Key: (1). Designation of metal. (2). Interval of hardness in numbers of Brinell. (3). Sizes/dimensions in mm. (4). kg. (5). s. (6). Steel and pig iron. (7). It is less. (8). It is more. (9). Nonferrous metals and alloys.

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Steel ball (scale B - HRB) is used for determining of the hardness of soft materials (softer than HRC20), but diamond cone - for solid metals (harder than HRB 100).

3. Toughness test (GOST 9454-60).

Impact toughness is called the ability of material to be resisted the effect/action of impact loads.

Impact toughness test is accomplished/realized on pendulum pile drivers. For testing are prepared the samples/specimens, which have the form of bars with square cross section/cut. In the middle part of the sample/specimen usually is made the established/installed size/dimension the cut on boring, milling or grinding machines. In this case it is necessary to avoid heating sample/specimen, which influences the mechanical properties of metal. If it is necessary, sample/specimen is worked thermally to cut.

Impact toughness with lowered/reduced temperatures (to minus of 100°C) is determined according to GOST 9455-60, and at elevated temperatures (to 1000°C) - according to GOST 9456-60. Test procedure, with exception of heating or cooling of samples/specimens, is analogous.

4. Testing for intercrystalline corrosion (GOST 6032-58).

Depending on technical requirements the tendency of articles made of corrosion resistant (not corroding) steels to

intercrystalline corrosion is determined by one of the following methods:

A - test/experience the samples/specimens of steels in the aqueous solution of the copper sulfate and sulfuric acid;

AM - just as according to method A, but in the presence of the copper shaving;

C - just as according to method A, but with the addition of the zinc dust;

B - etch the sections of the surface of articles by the anode;

D - test/experience samples/specimens in the boiling 65o/o nitric acid.

For tests of the ducts whose outside diameter is more than 20 mm cut out the longitudinal specimens with a length of 80 mm, by width from 10 to 20 mm and by thickness, equal the wall thickness of duct, but not more than 5 mm. With greater thickness the walls of duct excess metal remove/take with outer side.

During the control of welded joints the weld must pass on the

middle of test specimen.

At present for article testing for intercrystalline corrosion are used also the physical methods of control.

Ultrasonic technique of control with the aid of instrument UDM-1M makes it possible to determine the depth of corrosion to 10-15 μ.

By the method of eddy currents with the utilization of an instrument TM-57 TsNIL of Gosgortekhnadzor [State Committee of the Council of Ministers for Supervision of Industrial Safety and for Mining Inspection (RSFSR)] it is possible to determine the depth of corrosion from 10-20 to 200-250 μ.

The nonferrous method of control, based on the capillary penetration of the well hydrophilic liquid into the surface defects of metal, gives the possibility to detect the depth of corrosion of 5-8 μ and more.

5. Duct testing for knee (GOST 3728-66).

For determining the plasticity of metal the ducts whose outside diameter is not more than 114 mm test/experience with method to knee.

Flanging test of ducts in outside diameter to 60 mm are conducted on specimens - segments of ducts, and with diameter of 60 mm and more - on specimens cut from the ducts of the longitudinal strips with a width of 12 mm.

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Sample/specimen must have length, sufficient for its knee to preset angle and radius. Bend angle they indicate in technical requirements for ducts or take as the equal to 90°. The radius of mount/mandrel R, around which they bend sample/specimen, must be shown under technical specifications the ducts.

During testing sample/specimen they smoothly bend in any manner (on machine tool or by hand, with filler, on mandrel, etc.) so, in order to its outside diameter not in one place (both over the section/cut and along the length) it did not become less than 85o/o initial.

The samples/specimens of wrought pipes must hold out testing in any weld position, if under technical specifications for ducts is not caused its specific position.

Sample/specimen is considered held out testing, if on it after bend will not be discovered the disturbances/breakdowns of the integrity of metal (break, strains, lamination).

6. Duct testing by hydraulic pressure (GOST 3845-65).

Strength and density of ducts and welds check during the testing by their internal hydraulic pressure.

Maximum testing (test) pressure p_{np} (in kg/cm²) is determined from the formula

$$p_{np} = \frac{200 S R}{D_н - 2S}, \qquad (3)$$

where S - the minimally allowable wall thickness in mm; R - allowable stress during testing in kg/mm² (Table 22); $D_н$ - nominal outside diameter of duct in mm.

As the medium, which transmits pressure on the walls of duct, are used the water or another liquid. Prior to testing from duct must be distant the air by filling with its with that utilized for the testing by liquid.

Pressure buildup during testing must occur smoothly, without hydraulic impacts.

Time the holding of ducts under testing pressure accept according to GOST upon the appropriate type of ducts.

Duct is considered as that held out testing, if in this case will not be discovered leaks, sweatings or residual deformations (bulge).

Table 22. Allowable stresses during hydraulic test of ducts.

(1) ГОСТ на трубы	(2) Допускаемое напряжение	(3) № таблицы в данном справочнике для выбора $\sigma_в$ или $\sigma_т$
8731—66; 8733—66; 8732—70; 8734—58**	0,4 $\sigma_в$	9 (4) и 10 (5) главы II
9567—60*	0,4 $\sigma_в$	9 и 10 главы II
550—58	0,4 $\sigma_в$	11 главы II
9940—72; 9941—72	0,1 $\sigma_в$	14 главы II
10198—62*	(6) По соглашению сторон	
10704—63*; 10705—63*	0,4 $\sigma_в$	18 и 19 главы II
10704—63*; 10706—63	(7) В зависимости от марки стали и назначения труб	
10707—63; 10705—63*; 8733—66	0,4 $\sigma_в$	18 и 19 главы II
8696—62	0,85 $\sigma_т$	1 и 5 главы I
11068—64	0,4 $\sigma_в$	20 главы II

Key: (1). GOST to ducts. (2). Allowable stress. (3). Table in this reference for selection σ_B or σ_T (4). and. (5). chapter. (6). By agreement of sides. (7). Depending on brand/mark of steel and designation/purpose of ducts.

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7. Testing for flanging of duct (GOST 8693-58).

During testing use a duct or a cut the ducts with a length of not less 0.5D. By smooth flanging on 90° of end of the sample/specimen with the aid of mount/mandrel is obtained the prescribed/assigned diameter D (Fig. 1).

The value of flanging in percentages they calculate according to the formula

$$X = \frac{D - d}{d} 100 . \quad (3)$$

During testing is not allowed/assumed rotary motion of mount/mandrel or sample/specimen.

As the sign of the fact that the sample/specimen held out testing, serves the absence in it after flanging of cracks or strains.

8. Duct testing for distribution (GOST 8694-58).

Test/experience duct or sample/specimen, cut off from the end of the tested duct, with length ~2d at the angle of cone α to 30° and by length ~1.5d at the angle of cone α more than 30°, but in all cases not less than 50 mm.

Testing is accomplished/realized via the smooth distribution of the end of the sample/specimen by mount/mandrel with the prescribed/assigned angle of taper α before obtaining in the end/face of the sample/specimen of the smooth outside diameter D (Fig. 2).

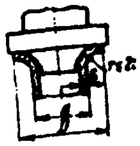

Fig. 1. Duct testing for flanging with the aid of mount/mandrel.

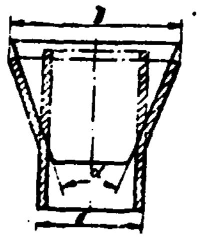

Fig. 2. Duct testing for distribution.

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The value of distribution in percentages they calculate also according to formula (3), accepting: D - the prescribed/assigned outside diameter of duct (after distribution) and d - an outside diameter of duct (to distribution).

During testing is not allowed/assumed rotary motion of feed or sample/specimen. The speed of the introduction of mount/mandrel to sample/specimen must be in the limits of 20-50 mm/min.

As the sign of the fact that the sample/specimen held out

testing, serves the absence in it after the distribution of cracks or strains.

9. Duct testing for flattening (GOST 8695-58).

Is tested duct, preliminarily notching it perpendicular to longitudinal axis at the depth not less than 0.8 $D_н$ duct or in the sample/specimen with a length of 20-50 mm, cut off from the end of the duct.

During testing the sample/specimen is placed between two parallel planes and smoothly they flatten to their approach up to the prescribed/assigned distance of H (Fig. 3a)[*].

FOOTNOTE 1.

$$H = \frac{1,08S}{0,08 + \frac{S}{D_н}}$$

ENDFOOTNOTE.

The speed of the flattening of sample/specimen must be in the limits of 20-50 mm/min.

During testing of wrought pipes the weld must be arranged/located on equidistance from the flattening planes (Fig.

3b), if is not prescribed/assigned its another position.

As the sign of the fact that the sample/specimen held out testing, serves the absence in it after the flattening of cracks or strains.

10. Duct testing for the distribution of ring by cone (GOST 11706-66).

To testing are subjected the ducts with a diameter of 18-150 mm with the wall with a thickness of 2-8 mm from which are cut out the ring-models with a width of 10-25 mm.

Tests conduct in general-purpose machines by the advance of the conical arbor inside sample/specimen whose velocity is not more than 50 mm/min.

Sample/specimen is considered held out testing, if on it there are no flaws, cracks, strains, laps and laminations. The value of the distribution of ring and the number of tests are established/installed by technical requirements.

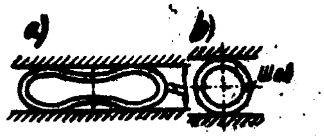

Figure 3. Duct testing for flattening. a) the flattening of the control sample/specimen; b) the position of the weld during testing of wrought pipes.

11. Duct testing by the torsional moment (GOST 12501-67).

During duct testing by the torsional moment determine the moments/torques of elastic limits, proportionality, yield and saturated torsional moment, provided for by standards and technical specifications for steel tubes.

For testing are used the cuts of the ducts of the total cross section, fastened by the clamps of testing machines for twisting.

The need for conducting tests by torsional moment is called for by the standard and technical conditions for steel ducts.

12. Velocity analysis of the chemical composition of a metal.

Directly before the assembly additionally is checked the conformity of the chemical composition of the metal of the critical/heavy-duty elements/cells of conduits/manifolds (duct, part of connections, the housing of fittings, etc.) accepted in projects and indicated in certificates via accelerated and simplified chemical

analysis by dropping point test or spectral analysis with the aid of special instruments.

Drop analysis. The presence in steel of chromium and molybdenum is determined by the method of the drop analysis of the metal of ducts.

For this on the duct (or part) being investigated by abrasive stone or by file clean area/site by size/dimension about 2 cm^2, arranged/located as far as possible horizontally.

Analysis is accomplished/realized on the freshly-ground degreased pad at room temperature and daylight. Conducting analysis at another temperature requires testing the correctness of reading the method used in control sample/specimen.

The presence of chromium is determined by the reagent, which consists of 13 parts by volume of the nitric acid (density 1.4) and 4 parts by volume of the distilled water.

With the content of chromium in metal less than 3o/o plotted/applied to ground surface drop of solution instantly is made foam, but if under drop appears the dull eliminated spot of the greenish gray color, a quantity of chromium composes 3o/o, and if

drop remains shiny, then the content of chromium is more than 3o/o.

When, in the tested metal, of nickel more than are present, 0.2o/o reading about the content of chromium by the reagent indicated the somewhat distorting presence of molybdenum and copper do not influence the course of reaction.

The presence of molybdenum is determined by the reagent, which consists of 2 parts by volume of the nitric acid (density 1.4), the parts by volume of the hydrochloric acid (density 1.19) and 15 parts by volume of the distilled water.

With the content in the metal of molybdenum less than 0.2o/o plotted/applied to the surface of metal drop of solution remain bright and transparent; with the content of molybdenum more than 0.2o/o drop of solution accept the light yellow coloring.

Testing the presence in steel of molybdenum can be also carried out by another method. To that prepared, as noted above, area/site by the size/dimension not less than 2 cm² will apply the drop of nitric acid with a specific weight of 1.12.

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After 2-3 min, when completely is discontinued, the effervescence within drop, to the strip of filter paper will be applied the drop of the 5o/o solution of potassium thiocyanate and they touch by it the drop on the surface of metal. At this place of paper is formed the spot of the dark red color. Then to this spot will be applied one-two drops of the solution of bichloride tin. If steel does not contain the alloying elements, paper completely is decolorized. In the presence of molybdenum on paper remains light rose-colored coloring.

Reagents for conducting the drop analysis should be stored in dark glass dishes with ground stopper, capacity not more than 200 cm^3.

During storage in reagent can occur chemical changes under the effect of light/world and heat. Therefore through the specific time intervals it is necessary to check the effect/action of reagent in the standard sample/specimen of the metal of previously known composition and in the case of inadequacy to prepare new solution.

Spectral analysis. The presence in steel of the alloying elements (chromium, molybdenum, tungsten, manganese, silicon, vanadium, titanium, niobium, nickel, etc.) without the damage of the parts of conduits/manifolds can be determined by the method of spectral analysis with the aid of steeloscope SLP-2.

Examining through the ocular of steeloscope the radiation spectrum of vapors of metal, which appears during the creation of electric arc (or spark) between the electrode of instrument and the tested metal, they compare it with control table. To each chemical element correspond the lines, which occupy the strictly defined places in spectrum; therefore with the aid of steeloscope it is possible to determine presence in steel of all basic alloying elements.

Before the spectral analysis on the part being investigated clean by grindstone or file area/site by size/dimension about 2 cm^2.

The duration of analysis for determining the content in the metal of five-six elements/cells comprises in average/mean 2-3 min.

§3. Classification of technological conduits/manifolds.

All technological conduits/manifolds depending on properties and parameters of the transported product, and also the requirements, presented to the quality of the material of ducts, manufacture, weld, assembly and tests, divide according to SNIP [Construction norms and regulations] III-G.9-62* into five groups and five categories (Table

23).

Gosgortekhnadzor of the USSR affirmed on 17 September, 1969, of the "rule of device and safe operation of conduits/manifolds for the combustible, toxic and liquefied gases (PGU-69)" which they are propagated to design, assembly and operation of the permanent steel gas lines for the transporting of the products indicated in the limits of operating pressures from 0.01 kg/cm² abs. to 2500 kg/cm² cottages. and operating temperatures from -150 to +700°C. By these rules all gas lines depending on the conventional pressure of transported gass subdivide into:

low-pressure gas lines to P_y 100 kg/cm² inclusively and by temperature to 700°C;

high pressure supply lines from P_y 101 to 2500 kg/cm² and by temperature to 510°C.

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Table 23. Classification of technological conduits/manifolds.

(2) Группа	(3) Наименование продуктов	(1) Категории I: (4) $P_{раб}$, кгс/см²	I: t, °C	II: $P_{раб}$, кгс/см²	II: t, °C	III: $P_{раб}$, кгс/см²	III: t°, C	IV: $P_{раб}$, кгс/см²	IV: t, °C	V: $P_{раб}$, кгс/см²	V: t, °C
А	(5) Продукты с токсическими свойствами: (6) сильнодействующие ядовитые вещества (СДЯВ) и дымящиеся кислоты	(7) Независимо	От −70 до +700	—	—	—	—	—	—	—	—
	(8) прочие продукты с токсическими свойствами	(9) Свыше 16	От −70 до +700	до 16	От −70 до +350	—	—	—	—	—	—
Б (B)	(12) Горючие и активные газы, легковоспламеняющиеся и горючие жидкости	(13) Независимо	350—700	25—64	250—350 и от −70 до 0	16—25	120—250 и от −70 до 0	до 16	От −70 до +120	—	—
В (C)	(14) Перегретый водяной пар	(15) Не ограничено	>450 до 610	≤39 вкл.	>350 до 450 вкл.	≤22 вкл.	>250 до 350 вкл.	>0.7 до 16 вкл.	>115 до 250 вкл.	—	—
		>39	≤450 вкл.	>22 до 39 вкл.	≤350 вкл.	>16 до 22 вкл.	≤250 вкл.				
Г (D)	(17) Горячая вода и насыщенный водяной пар	>80	>115	>39 до 80 вкл.	>115	>16 до 39 вкл.	>115	≤16 вкл.	>115	—	—
Д (E)	(18) Негорючие жидкости и пары, инертные газы	Независимо	450—700	64—100	350—450 и от −70 до 0	25—64	250—350 и от −70 до 0	До 25	120—200 и от −70 до 0	До 16	0—120

Notes: 1. In the case of the absence in the table of the necessary combination of the parameters should be been guided that parameter (temperature or pressure), which requires the reference of conduits/manifolds to the highest category.

2. Conduits/manifolds, which work under a vacuum to 35 mm Hg are below, they are classified according to table according to properties and temperature of product, but it is more than 35 mm Hg - according to special technical specifications.

3. Conduits/manifolds, which transport liquefied gases, are classified according to group B, but with reference by one category it is higher.

Key: (1). Category. (2). Group. (3). Designation of products. (4). kg/cm². (5). Products with toxic properties. (6). strong toxic substances (SDYaV) and fuming acids. (7). It is independent. (8). other products with toxic properties. (9). It is more than. (10). From. (11). to. (12). Hot and reactive gases, which are inflammable and flammable liquids. (13). It is independent. (14). Overheated water Vapor. (15). It is not limited. (16). Inclusive. (17). Hot water and saturated steam. (18). Unburning liquids and vapors, inert gases.

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For the conduits/manifolds, which transport hot water and vapors, by Gosgortekhnadzor of the USSR on 10 March, 1970, are also affirmed the "Rules of device and safe operation of the pipelines of vapor and hot water".

§4. Corrosion resistance of the materials of pipelines.

Corrosion resistance of metals and alloys is determined by

weight or deep index.

With weight exponent of corrosion resistance of any material in this medium is expressed by the value of the loss of the mass of material, referred to unity area, for the specific time interval ($g/m^2/h$).

With depth index the rate of corrosion is determined by the magnitude of losses of material in mm/year.

For the evaluation of corrosion resistance of metals and alloys according to loss the masses use the five-point scale, but according to deep index - the ten-ball scale (GOST 13819-68). Virtually more frequently they put to use the five-point scale.

The comparison of the evaluations of corrosion resistance of metals and alloys according to the five- and ten-ball scales, and also the taken in this handbook evaluations of durability according to groups are given in Table 24.

Table 24. Evaluation of corrosion resistance of metals and alloys.

(1) По пятибалльной шкале		(2) По десятибалльной шкале (ГОСТ 13819—68)		(3) Принятая в данном справочнике		
(4) стойкость	(5) балл	(4) стойкость	(5) балл	(6) группа стойкости	(7) скорость коррозии в мм/год	(8) условное обозначение
(9) Весьма стойкие	1	(10) Совершенно стойкие	1	(11) Вполне стойкие	<0,1	В
		(12) Весьма стойкие	2, 3			
		(13) Стойкие	4, 5			
(13) Стойкие	2	(14) Пониженно стойкие	6, 7	(13) Стойкие	0,1—1	Х
(14) Пониженно стойкие	3	(15) Малостойкие	8	(15) Малостойкие	1—3	О
(16) Малостойкие	4	(15) Малостойкие	9	(16) Нестойкие	>3	Н
(16) Нестойкие	5	(16) Нестойкие	10			

Key: (1). According to the five-point scale. (2). According to ten-ball scale. (3). Accepted in this handbook. (4). Durability. (5). Point. (6). Group of durability. (7). rate of corrosion in mm/year. (8). conventional designations. (9). Very stable. (10). Completely stable. (11). Completely stable. (12). Very stable. (13). Stable. (14). It is lowered/reduced stability. (14). It is lowered/reduced stability. (15). Oil-resistant. (16). Unstable.

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The transported on pipelines products by the degree of aggressiveness usually divide into:

a) nonagressive ones and slightly agressive ones, corrosive whose speed does not exceed 0.1 mm per annum;

b) moderately aggressive, corrosive whose speed is located within the limits from 0.1 to 0.5 mm per annum;

c) highly aggressive, corrosive whose speed is above 0.5 mm per annum.

For the pipelines, used in chemical, petroleum and other branches of industry, the maximum permissible rate of corrosion is limited to the value of 0.5 mm per annum.

Conduct about corrosion resistance of different materials, the used for technological ones pipeline, is given in Table 25 in which for each, aggressive medium, according to Table 24, are accepted the conventional literal evaluations of durability with the specific temperature and with concentration of the medium indicated.

For media with two intervals of concentrations the first literal evaluation of the resistance of this material is related to the firsc, and the second to the second interval - an interval of medium concentration.

Thus, for instance. for sulfuric acid with concentration 70-75o/o carbon steel will be stable at temperature of 20°C; in Table 25 corrosion resistance is designated by beechnut X; at the same temperature, but with concentration 96-98o/o carbon steel completely is stable: the designation of corrosion resistance the same table gives by letter V; whereas at temperature of 100°C and concentration of sulfuric acid 70-75o/o the carbon steel not is stable and in the table is designated by letter N ~~H~~, but at concentration 96-98o/o and the same temperature carbon steel will be stable - designation is given by letter KhV ~~X~~.

In the absence of the sufficient information about corrosion resistance of materials with the specific temperatures and with concentration of medium in Table 25 is written the sign of dash (-). The data about durability of materials at a boiling point (Keep) are related to the boiling points of liquids and to the aqueous solutions of different inorganic and organic compounds.

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Table 25. Corrosion resistance of pipelines from metals, alloys and nonmetallic materials in different mediums[1].

FOOTNOTE [1]. Correction. The values of temperatures, given in Table 25, are related to each concentration of agressive medium, without depending on their dividing line. END FOOTNOTE.

(4) Наименование среды	(5) Концентрация в %	(6) Температура в °С	(1) Материал: (7) сталь углеродистая	(2) сталь типа ХН: Х21Н5Т	Х18Н10Т	Х17Н13М2Т	(3) чу…: (8) серый
							(16) Неорганические
(17) Аммиак NH_3 (19) То же, водный раствор NH_4OH	(18) Газ (20) До 26—30	20 60 100	В, В В, — Х, Х	—, — —, — —, —	В, В —, В В, В	В, В —, В В, В	В, В —, — В, Х
(21) Аммоний азотнокислый NH_4NO_3 (водные растворы)	(20) До 64	20 60	Х, Х —, —	—, — —, —	В, В В, В	В, В В, В	В, Н —, —
(22) Аммоний сернокислый $(NH_4)_2SO_4$ (водные растворы)	(20) До 43	100 Кип (23)	—, Н —, —	—, В —, —	В, В В, В	В, В В, В	—, — —, —
(24) Кислота азотная HNO_3	20—40	20 60	Н, Н —, —	В, В В, —	В, В В, —	В, В В, —	Н, Н —, —
	50—70	100 Кип (23)	—, — —, —	В, В В, Х	В, В В, Х	В, Х В, Х	—, — —, —
(25) То же, дымящая	90	20 60 100 Кип (23)	Н — — —	В — — Н	В — Н Н	Х — Н Н	Н — — —
(26) Кислота серная H_2SO_4	20—40	20 60	Н, Н —, —	—, — —, —	Н, Н —, —	В, О —, —	Н, Н —, —
	30—60	100 Кип (23)	Н, — —, —	—, — Н, —	Н, — —, —	—, Н —, —	—, — —, —
	70—75	20 60	Х, В —, Х	—, — —, Х	Х, В —, —	Х, В —, —	Х, Х —, —
	96—98	100 Кип (23)	Н, Х —, —	—, — —, О	Н, Н —, —	Н, Н —, —	—, Н —, —

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Continuation Table 25.

трубопровода									
гун (9) кремнистый	Al	Cu	Pb	(10) полиэтилен	(11) поливинилхлорид	(12) фторопласт-4	(13) фаолит	(14) резина бутил-каучук	(15) керамика кислотоупорная
соединения									
В, В —, — —, Х	В, Х —, — В, —	Н, Н —, — —, —	В, Х —, — В, —	В, В В, В —, —	В, В В, В —, —	В, В В, В В, В	В, В —, Х —, Х	В, В О, Б —, —	В, В —, Б —, В
В, В —, В	В, В —, —	Н, Х —, —	Н, В —, —	В, В В, В	В, В В, Х	В, В В, В	В, В В, В	В, В В, В	В, В В, В
—, — —, —	В, — —, —	—, Н —, —	—, Х —, —	В, — —, —	Н, — —, —	В, В —, —	—, В —, —	—, — —, —	В, В В, В
В, В —, —	О, Н —, —	Н, Н —, —	Н, — —, —	В, Х Х, Н	В, Х Х, Х	В, В В, В	—, Н Н, —	В, Н Х, —	В, В В, В
—, — Х, —	Н, — —, —	—, — —, —	—, — —, —	—, — —, —	—, — —, —	В, В —, —	—, — —, —	—, — —, —	В, В В, В
В — — —	В Х Н —	Н — — —	— — — —	Н Н — —	Н — — —	В В В —	Н — — —	Н — — —	В В В В
В, В В, В	Н, Н —, —	Х, Н —, —	В, В —, —	В, В В, В	В, В Х, Х	В, В В, В	В, В В, В	В, В —, В	В, В В, В
Х, — —, Х	Н, Н —, —	—, Н —, —	—, В —, —	—, — —, —	—, — —, —	—, В —, —	В, — —, —	Х, — —, —	В, В В, В
В, В В, В	Н, В —, —	Н, Н —, —	В, Х —, —	В, О О, Н	В, Х О, Н	В, В В, В	Х, Н —, —	В, Н Х, Н	В, В В, В
[illegible], В [illegible], В	Н, Н —, —	Н, Н —, —	—, Х —, —	Н, — —, —	—, — —, —	В, В —, —	О, Н —, —	—, — —, —	В, В В, —

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Continuation Table 25.

Кислота серная, дымящая (олеум) $H_2SO_4+SO_3$	До 20 свободного SO_3	20 60 100	Х Х —	— — —	В В Х	В В —	Х — —
(24) Кислота фосфорная H_3PO_4	10—40	20 60	Н, Н —, —	В, В В, —	В, В В, В	В, В —, В	Н, Н —, —
	60—65	100 Кип (23)	—, — —, —	В, — В, В	Х, Х Х, —	В, Х Х—О	—, — —, —
	85	20 60 100 Кип (23)	Н — — —	В — В Х	В В Х —	В В О О	Н — — —
(30) Кислота хлористоводородная HCl	10	20 60	Н, Н —, —	—, — —, —	О, Н —, —	Х, Н —, —	Н, Н —, —
	20—30	100 Кип (23)	—, — —, —	—, — —, —	—, — Н, —	—, — —, —	—, — —, —
	35—37	20 60 100 Кип (23)	— — — —	— — — —	Н — Н —	Н — Н —	Н — — —
(31) Натрий сернокислый Na_2SO_4 (водный раствор)	До 34,5 (20)	20 60	Х, В —, Х	—, — —, —	В, В В, В	В, В В, В	В, В В, В
(32) Натрий углекислый Na_2CO_3 (водный раствор)	(20) До 17	100 Кип (23)	Х, Х Н, —	В, В —, —	В, В В, В	В, В В, В	В, В В, В
(33) Натрий хлористый NaCl (водный раствор)	(20) До 26,4	20 60	В, В —, —	В, В В, В	В, В —, —	В, В В, —	О, В —, —
(34) Натрий гидроокись NaOH (водный раствор)	(20) До 82	100 Кип (23)	Х, В —, —	—, В —, В	Х, Х Х, Х	В, Х В, Х	О, В —, —

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Continuation Table 25.

B — H	X — —	H — —	H — —	H H —	O H —	B — X	H — —	H — —	B B B
B, B —, —	O, H H, —	X, B X, B	X, X —, —	B, B B, B	B, B B, X	B, B B, B	B, B B, B	B, B B, B	B, B —, —
B, B X, —	H, — —, —	—, — O, —	H, H —, —	—, — —, —	—, — —, —	B, B —, —	B, X —, —	—, — —, —	B, B —, —
B B O H	H — — —	B X — X	B B X —	B X — —	B X — —	B B B —	X X O —	B B — —	O — H —
X, X X, —	H, H —, —	H, X —, —	H, H —, —	B, B B, B	B, B B, X	B, B B, B	B, B B, B	B, B B, X	B, B B, B
H, — —, H	—, — —, —	O, H —, —	—, — —, H	—, — —, —	—, — —, —	B, B —, —	B, B —, —	—, H —, —	B, B B, B
X — — H	H — — —	H — — —	H — — —	B B X —	B B — —	B B B —	X X — —	B B — —	B B B B
B, B B, —	B, H —, —	X, B —, —	B, B B, H	B, B B, B	B, B B, B	B, B B, B	B, B B, B	B, B B, B	B, O B, O
B, X B, X	B, — —, H	—, — B, B	X, H —, —	B, — —, —	—, — —, —	B, B —, —	B, B B, —	—, — —, —	B, O B, —
B, X B, —	H, H —, H	X, B —, —	B, B B, —	B, B B, B	B, B X, B	B, B B, B	B, H B, H	B, B B, B	B, O B, O
[illegible] X [illegible] —	—, H —, —	X, X —, —	—, B —, —	B, B —, —	H, B —, —	B, B —, —	B, — —, —	B, B —, —	B, H —, —

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Continuation Table 25.

(34) Сернистый ангидрид SO_2	(18) Газ	20 60	В, В —, —	—, — —, —	В, В —, Х	В, — —, —	В, — —, —
(35) Серный ангидрид SO_3	»	100	—, —	—, —	В, —	В, —	—, —
(36) Хлор (сухой и жидкий) Cl_2	—	20 60	В, В —, —	—, — —, —	В, В —, —	В, В —, —	В, В Х, —
(37) Хлористый водород HCl	(38) Газ сухой	100	Х, В	—, —	Х, Х	В, В	О, Х
(39) Органические							
(40) Ацетилен CH-CH	—	20	В	—	В	В	В
(41) Бензин	—	20	В, В	В, В	В, В	В, В	В, В
(42) Бензол C_6H_6	—	(23) Кип	В, Х	—, В	В, В	В, В	В, В
(43) Кислота уксусная CH_3CO_2H	25	20 60	Н, Н —, —	В, В —, —	В, В В, —	В, В В, В	Н, Н —, Н
	50	100 Кип (23)	—, — —, —	В, В —, Х	Х, В Х, Х	В, В В, В	—, Н —, Н
(44) Масла минеральные	—	20 60	В, В —, —	В, — —, —	В, В —, —	В, В В, —	В, В В, —
(45) Масла — жиры растительные и животные	—	100	—, —	—, —	—, В	—, В	—, —
(46) Мочевина (карбамид) H_2NCONH_2	—	20 60 100	Х Х —	— — В	В — —	В — Х	В В —

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Continuation table 25.

B, — —, —	B, B —, —	B, B X, —	B, B X, —	B, — B, —	B, B X, B	B, — B, —	B, B —, —	B, B B, —	B, — B, —
B, —	X, —	X, —	X, —	—, —	H, —	B, —	B, —	—, —	B, —
X, B —, —	B, B —, —	B, B —, —	B, X X, X	X, B H, B	B, B X, B	B, B B, B	B, B B, X	X, — X, —	B, B B, —
O, B	X, B	B, X	X, O	H, —	—, —	B, B	B, X	—, —	B, —
соединения									
—	B	H	B	B	X	B	—	B	B
B, B	B, B	B, B	B, B	X, X	B, H	B, B	B, B	H, H	B, B
—, B	B, X	B, X	B, B	—	—	—, B	B, B	—	—, B
B, B B, B	B, B X, X	X, λ —, —	X, X —, —	B, B B, B	B, B X, X	B, B B, B	B, B B, B	B, B B, X	B, B B, B
B, B B, B	—, — H, H	O, — O, X	—, — —, —	—, — —, —	—, H —, —	B, B —, —	B, B —, —	H, H —, —	B, B B, B
—, B —, —	B, B —, —	B, B —, B	B, X —, X	B, X B, X	B, B B, B	B, B B, B	B, B —, X	X, B H, B	B, B B, B
—, —	—, B	—, B	—, X	—, —	—, —	B, B	—, O	H, —	—, B
B — B	B — B	B B —	B B B	B B —	B B —	B B B	B — —	B — —	B — —

Key: (1). Material of pipeline. (2). steel of type XH. (3). pig iron. (4). Designation of medium. (5). Concentration in o/o. (6). Temperature in °C. (7). steel carbide. (8). gray. (9). silicon. (10). polyethylene. (11). polyvinyl chloride. (12). teflon. (13). faolite.

(14). rubber butyl rubber. (15). ceramics acid-resistant. (16). Inorganic connections. (17). Ammonia NH_3. (18). Gas. (19). ~~Then,~~ The same, aqueous solution NH_4OH. (20). To. (21). Ammonium nitrate NH_4NO_3 (aqueous solutions). (22). Ammonium sulfate $(NH_4)_2SO_4$ (aqueous solutions). (23). Bales. (24). Acid nitric HNO_3. (25). The same, fuming. (26). Acid sulfuric H_2SO_4. (27). Acid sulfuric, which fumes (oleum). (28). free. (29). Acid phosphoric. (30). Acid hydrochloric. (31). Sodium sulfate Na_2SO_4 (aqueous solution). (32). Sodium carbonate Na_2CO_3 (water/aqueous solution). (33). Sodium chloride NaCl (aqueous solution). (34). Sodium hydroxide NaOH (aqueous solution. (35). Sulfurous anhydride. (36). Chlorine (dry and liquid). (37). Hydrogen chloride. (38). Gas of dry. (39). Organic compounds. (40). Acetylene. (41). Gasoline. (42). Benzene. (43). Acid acetic. (44). Oils (mineral. (45). Oils - fats (plant and animals). (46). Urea (carbamide).

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§5. Internal diameters and pressures.

1. The internal diameters (GOST 355-67).

Internal diameter D_y of ducts, connecting pieces (fittings) and reinforcement is called the nominal bore of article on leads.

Steel seamless pipes according to the conditions for technological processes are prepared with the series/number of permanent outside diameters. Because of this with the purpose of providing the strength of the pipelines, which work at the increased or high pressures, are increased their wall thicknesses, which causes the deviations of tube bores from the internal diameters, accepted by GOST 355-67.

The internal diameter of flanges and connecting pieces (offtakes, it is branch and the like) they accept on the internal diameter of those ducts, for which they are intended.

The values of the internal diameters of ducts, reinforcement, connecting pieces, and also all parts of the technological equipment and instruments, to which are added the ducts or reinforcement, are established/installed by GOST 355-67.

For the technological pipelines most acceptable are internal diameters D_y (in mm): 6; 10; 15; 20; 25; 32; 40; 50; 65; 80; 100; 125; 150; 200; 250; 300; 350; 400; 500; 600; 800; 1000; 1200; 1400; 1600; 2000.

2. Conventional, working and test pressures (GOST 356-68).

Conventional pressure P_y - this great excess operating pressure (at temperature of medium of 20°C), at which is provided the prolonged work of reinforcement and connecting pieces, which have the specific sizes/dimensions, substantiated by strength calculation with the selected materials and the characteristics of their strength at temperature of 20°C.

As operating pressure $P_{раб}$ is considered the great overpressure, which ensures the prolonged work of reinforcement and connecting pieces of the pipelines at operating temperature of the conducted medium.

Test pressure $P_{пр}$ is called the overpressure at which the reinforcement and the connecting pieces of the pipelines must undergo hydraulic test for strength and density of material by water at temperature not higher than 100°C.

Conventional pressure P_y establishes the connection between working pressure $P_{раб}$ of the conducted medium and its temperature.

For a reinforcement and the connecting pieces of the pipelines made of carbon and alloy steels, pig iron, bronze and brass of the

value of conventional, test, and also greatest permissible operating pressures depending on the temperature of the transported product are established/installed GOST 356-68.

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The maximum permissible temperatures of medium in °C for carbon and alloy steels comprise:

by carbide (S), manganous and silicon manganese (G) ... 455.

chrome-silicon manganese (KhG) ... 370.

molybdenum-chromium (MKh) ... 530.

chrome-molybdenum (KhM) ... 545.

chrome-molybdenum-vanadium (KhMF) ... 570.

chrome-titanate (Kh5T) ... 425.

chrome-molybdenum and chrome-tungsten (Kh5) ... 550.

chrome-tungsten (Kh8) ... 575.

chromium-molybdenum-vanadium (KhF) ... 510.

chromium-nickel-titanium and chromium-nickel-tungsten (KhN) ... 700.

For the ducts, used during the manufacture of pipelines, GOST 356-68 is recommended. To pipelines in the assembled form the standard indicated is not propagated.

The values of conventional, test and operating pressures depending on the temperature of medium for ducts, reinforcement and connecting pieces made of steel, pig irons, bronze and brass are given in Table 26.

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Table 26. Pressure (excess) conventional, test and workers in kg/cm (GOST 356-68)./

(2) Материал, из которого изготовлены арматура и соединительные части	(3) Температура среды в °C	(1) Условные давления P_y								
		1	2,5	4	6	10	16	25	40	64
		(4) Пробные давления $P_{пр}$								
		2	4	6	9	15	24	38	60	96
		(5) Наибольшие рабочие давления $P_{раб}$								
(6) Углеродистая (C < 0,3%), марганцовистая и кремнемарганцовая сталь	(7) До 200	1	2,5	4	6	10	16	25	40	64
	250	0,9	2,2	3,6	5,6	9	14	22	36	56
	300	0,8	2	3,2	5	8	12,5	20	32	50
	350	0,7	1,8	2,8	4,5	7	11	18	28	45
	400	0,6	1,6	2,5	4	6,4	10	16	25	40
	425	0,6	1,4	2,2	3,6	5,6	9	14	22	36
	435	0,5	1,2	2	3,2	5	8	12,5	20	32
	445	0,5	1,1	1,8	2,8	4,5	7	11	18	28
	455	—	1	1,6	2,5	4	6,4	10	16	25
(8) Чугун серый и ковкий	(7) До 120	1	2,5	4	6	10	16	25	40	—
	200	1	2,5	3,6	5,5	9	15	23	36	—
	250	1	2	3,4	5	8	14	21	34	—
	300	1	2	3,2	5	8	13	20	32	—
	350	0,8	1,9	3	4,5	7,5	12	18	30	—
	400	0,7	1,6	2,8	4,2	7	10	16	28	—
(9) Бронза и латунь	(7) До 120	1	2,5	4	6	10	16	25	40	64
	200	1	2	3,2	5	8	13	20	32	—
	250	0,7	1,7	2,7	4	7	11	17	27	—

(6) Углеродистая (C<0,3%), марганцовистая и кремнемарганцовая сталь	(7) До 200	100	160	200	250	320	400	500	640	800	1000
	250	90	140	180	225	280	360	450	560	710	900
	300	80	125	160	200	250	320	400	500	640	800
	350	71	112	140	180	225	280	360	450	560	710
	400	64	100	125	160	200	250	320	400	500	640
	425	56	90	112	140	180	225	280	360	450	560
	435	50	80	100	125	160	200	250	320	400	500
	445	45	71	90	112	140	180	225	280	360	450
	455	40	64	80	100	125	160	200	250	320	400
(8) Чугун серый и ковкий	(7) До 120	—	—	—	—	—	—	—	—	—	—
	200	—	—	—	—	—	—	—	—	—	—
	250	—	—	—	—	—	—	—	—	—	—
	300	—	—	—	—	—	—	—	—	—	—
	350	—	—	—	—	—	—	—	—	—	—
	400	—	—	—	—	—	—	—	—	—	—
(9) Бронза и латунь	(7) До 120	100	160	200	250	—	—	—	—	—	—
	200	—	—	—	—	—	—	—	—	—	—
	250	—	—	—	—	—	—	—	—	—	—

Notes: 1. Operating pressures for the intermediate values of the temperature of medium are determined by linear interpolation between

the nearest values. At determination of the value of conventional pressure from operating pressure and temperature of medium is allowed/assumed the excess of operating pressure in limits to 5o/o of indicated in table for the prescribed/assigned temperature without transition to the highest step/stage conventional pressure.

2. In the case of applying of reinforcement and connecting pieces for work under conditions of frequent hydraulic impacts, pulsing pressures, variable temperatures, specific properties of transported product or limited service life of pipelines value of operating pressure is determined with consideration correction factor, adjusted by organs/controls of engineering supervision.

3. First stage of operating pressure of reinforcement and connecting pieces made of carbon, manganous and silicon manganese steels indicated is propagated to minus temperatures of medium not below minus 20°C, and from pig iron, bronze, brass - not below minus 30°C.

4. Pig iron connecting pieces and reinforcement for conventional pressures 25 and 40 kg/cm² and for temperatures more than 300°C can be used only from malleable cast iron.

5. At operating pressure is below 1 kg/cm² value of test

pressure $P_{np}=P_{pa6}+1$ by kg/cm², while with vacuum $P_{np}=1.5$ kg/cm², if these values are not established/installed by another technical documentation.

Key: (1). Conventional pressures. (2). Material from which are manufactured reinforcement and connecting pieces. (3). Temperature of medium in °C. (4). Test pressures. (5). Greatest operating pressures. (6). Carbon (C<0.3o/o) manganous and silicon-manganese steel. (7). To. (8). Pig iron (gray and ductile). (9). Bronze and brass.

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§6. Calculation of pipelines and determination of the volumes of liquids in vessels and ducts.

1. Calculation of pipelines.

During the assembly of technological pipelines frequently appears the need in the use/application of temporary/time pipelines and horizontal cisterns for the hydraulic or pneumatic tests of the assembled networks/grids of pipelines.

In such cases the volume of pipelines and capacities is the value of known and it is required to determine the diameter of

temporary/time pipelines, and to also manufacture the strenth calculation of ducts.

Determination of the calculated diameter of pipeline. The internal (calculation) diameter of pipeline with the prescribed/assigned fluid flow rate and speed of its flow in pipeline is determined from the formula

$$d=\sqrt{\frac{4Q}{3600\pi v}}\ m, \qquad (5)$$

where Q - fluid flow rate in the m^3/h;

v - rate of flow of liquid in pipeline in m/s.

The rate of flow of liquid in pipeline usually is accepted:

a) for water and low-viscosity liquids (alcohol, acetone, gasoline, dilute solutions of acids and alkalis, etc.) - from 1 to 2.5 m/s;

b) for liquids with large viscosity/ductility/toughness (oil, suspension, etc.) - from 0.5 to 1.5 m/s;

c) for the compressed air and the saturated steam - from 20 to 30 m/s;

d) for the superheated steam and high-pressure gases - from 30 to 60 m/s.

Example. To determine the diameter of the pipeline by which it is required to pump 90 m³ of water in hour at the speed of its motion 2 m/s.

$$d=\sqrt{\frac{4\cdot 90}{3600\cdot 3,14\cdot 2}}=0,126\ м=126\ мм.$$

After obtaining the calculated diameter of pipeline, select from assortment the adequate/approaching duct according to outside diameter and thickness walls.

Strength calculation of ducts. The wall thickness of steel tubes is determined from the formula

$$S=\frac{PD_н}{200\sigma_{доп}\varphi+P}+C\ мм, \qquad (6)$$

where P - design pressure in pipeline in kg/cm²;

$D_н$ - outside diameter of duct in mm;

$\sigma_{доп}$ - allowable tensile stress in kg/mm² in dependence on the temperature of the transported product (Table 27).

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ϕ - modulus of resistance of the weld; for seamless pipes $\phi=1$; for the ducts, connected by automatic and manual electric welding during partial quality control of welds, $\phi=0.85$; for other cases of manual electric and torch welding of ducts $\phi=0.7$;

C - addition, which considers the minus tolerance of the wall thickness of duct according to GOST and possible thinning of wall during flexure within the permissible limits; C is accepted equal to 15-20o/o wall thickness, but is not less than 0.5 mm.

In all cases the nominal wall thickness of duct must be not less:

(1) для труб диаметром до 38 мм	1,75 мм
(2) то же, до 51 мм	2 »
» » 70 »	2,5 »
» » 90 »	3 »
» » 108 »	3,5 »

Key: (1). for ducts by diameter to. (2). The same, to 51 mm.

Example. To determine the wall thickness of pipeline at the pressure by P=80 kg/cm², outside diameter $D_н=108$ мм. Ducts are electric welding made of steel brands 20. Temperature of pumped liquid of 20°C.

According to formula (6) and Table 27 the wall thickness of duct will comprise:

$$S=\frac{80\cdot 108}{200\cdot 14,7\cdot 0,85+80}+0,5\ мм=3,85,$$ or is rounded 4 mm.

Table 27. Allowable tensile stresses for ducts made of carbon and alloy steels in dependence on the temperature of the transported product.

(2) Расчетная температура в °С	(1) Марка стали							
	Ст. 2	10	Ст. 3	20	12МХ	15ХМ	12Х1МФ	Х18Н10Т, Х18Н12Т
	(3) Допускаемое напряжение на растяжение в кгс/мм²							
20	13	13	14	14,7	14,7	15,3	17,3	14,6
100	12,3	12,4	13,3	14,2	14,6	15,3	17,1	13,9
150	11,8	12	12,9	13,9	14,6	15,2	16,9	13,4
200	11,4	11,6	12,4	13,5	14,5	15,2	16,8	13
250	10,9	11,2	12	13,2	14,5	15,2	16,6	12,5
275	10,3	10,6	11,4	12,6	14,3	14,9	16,2	12,2
300	9,8	10	10,[illegible]	11,9	14,1	14,7	15,9	12
400	—	7,7	—	9,2	13,2	13,7	14,5	11,1

Note. For the temperatures of intermediate values the value of allowable stress is determined by interpolation of two nearest values with the rounding of result to 0.05 kg/mm² to the side of smaller value. Key: (1). Trademark of steel. (2). Calculated temperature in °C. (3). Allowable tensile stress in kg/mm².

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Determination of the permissible pressure in pipeline. The value of the permissible operating pressure of pipeline is determined from the formula

$$P_{раб} = \frac{200(S-C)\varphi\sigma_{доп}}{D_н-(S-C)} \text{ кгс/см}^2. \qquad (7)$$

Key: (1). kg/cm².

Example. To determine the permissible operating pressure in pipeline, after accepting initial data of the preceding example and thickness of wall 4 mm:

$$P_{раб}=\frac{200\,(4-0,5)\,0,85\cdot 14,7}{108-(4-0,5)}=83,7 \text{ kg/cm}^2.$$

Determination of test pressure. Test pressure in pipeline must not exceed the value, determined according to to the formula

$$P_{пр}=\frac{240\,(S-C)\,\varphi\sigma^{20}_{доп}}{D_н-(S-C)}\ \overset{(1)}{кгс/см^2}, \tag{8}$$

Key: (1). kg/cm²,

if

$$\frac{S-C}{D_н}<0,13,$$

and according to the formula

$$P_{пр}=315\,\frac{S-C}{D_н}\left(1-\frac{S-C}{D_н}\right)\varphi\sigma^{20}_{доп}\ \overset{(1)}{кгс/см^2}, \tag{9}$$

Key: (1) kg/cm²

if

$$\frac{S-C}{D_н}>0,13.$$

Example. To determine permissible test pressure in pipeline according to initial data of the preceding example.

For solution it is necessary to accept formula (8), since

$$\frac{S-C}{D_н} = \frac{4-0,5}{108} = 0,03 < 0,13 \text{ and then}$$

$$P_{пр} = \frac{240\,(4-0,5)\,0,85\cdot 14,7}{108-(4-0,5)} = 100,4 \text{ kg/cm}^2.$$

During the strength calculation of ducts according to formula (6) addition C is provided for for the pipelines, which transport nonagressive and slightly agressive products.

For the pipelines, which transport agressive products, must be considered the addition for corrosion.

The values of addition for corrosion for ducts made of carbon and alloy steels are given in Table 28-30.

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Table 28. Value of addition for corrosion in mm for ducts on P_y to 100 kg/cm² (MN 2566-61 and 4765-63).

<table>
<tr><th rowspan="2">D_y, мм</th><th colspan="3">(1) Трубы из стали</th></tr>
<tr><th>(2) углеродистой</th><th>(3) легированной</th><th>(4) легированной нержавеющей</th></tr>
<tr><td>10—40</td><td>1,5—2</td><td rowspan="3">1,5—3,5</td><td rowspan="2">1—1,5</td></tr>
<tr><td>50—80</td><td rowspan="2">3,5—4,5</td></tr>
<tr><td>100</td><td rowspan="2">2</td></tr>
<tr><td>125 и выше (5)</td><td>4—6</td><td>3—6</td></tr>
</table>

Key: (1). Ducts made of steel. (2). carbide. (3). alloyed. (4). by alloyed not corroding. (5). and above.

Table 29. Value of addition for corrosion in mm for ducts on P_y 160-400 kg/cm² (MN 3558-62).

<table>
<tr><th rowspan="2">D_y, мм</th><th colspan="3">(1) Трубы из стали</th></tr>
<tr><th>(2) углеродистой марки 20</th><th>(3) легированной марок Х5, Х5М, Х5М-У, Х5ВФ</th><th>(3) легированной марок Х18Н10Т и Х17Н13М2Т</th></tr>
<tr><td>6—40</td><td rowspan="2">1—3</td><td rowspan="2">1—3</td><td>1</td></tr>
<tr><td>50—70</td><td rowspan="4">2</td></tr>
<tr><td>80—100</td><td>4—5</td><td rowspan="2">3,5—5</td></tr>
<tr><td>150—200</td><td rowspan="3">6—8</td></tr>
<tr><td>200—250</td><td>5—6</td></tr>
<tr><td>250—400</td><td>6—7</td><td>—</td></tr>
</table>

Key: (1). Ducts made of steel. (2). carbide brand 20. (3). alloyed of brands/marks.

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Table 30. Value of addition for corrosion in mm for ducts on P_y =200-1000 kg/cm² (НН 5010-63).

<table>
<tr><th rowspan="2">D_y, мм</th><th colspan="2">(1) Трубы из стали групп</th></tr>
<tr><th>С, ХГ, ХМ, ХФ</th><th>ХН</th></tr>
<tr><td>6</td><td>1,5</td><td>1</td></tr>
<tr><td>10</td><td rowspan="2">2</td><td>1—1,5</td></tr>
<tr><td>15</td><td rowspan="3">1,5—2</td></tr>
<tr><td>25</td><td>2—2,5</td></tr>
<tr><td>32; 40</td><td rowspan="2">2,5—3</td></tr>
<tr><td>50</td><td>2,5</td></tr>
<tr><td>70—100</td><td>3,5—4,5</td><td>3</td></tr>
<tr><td>125—200</td><td>5,5—7</td><td>4</td></tr>
</table>

Key: (1). Ducts made of steel of groups.

2. Determination of the volumes of liquids in horizontal cylindrical containers and ducts.

During hydraulic tests of the assembled pipelines to strength and density frequently appears the need for using finished cylindrical horizontal capacities (cistern). To these capacities connect the temporary/time pumping pumping plants with brace networks/grids for connection with the tested pipelines.

The volume of liquid in horizontal cylindrical containers is determined from the formula

$$V_{ж} = V_{c} k, \qquad (10)$$

where V_c – the full/total/complete volume of vessel, equal to $\frac{\pi d^2}{4} l$;

k – multiplier value which they take on Table 31 depending on the value of relationship/ratio h/d,

d – a bore of the vessel;

h – height of the layer of liquid in the vessel;

l – length of vessel.

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The volume of water in ducts with the most frequently used outside diameters and in thicknesses of walls, areas and surfaces 1 m of ducts are given in Tables 32 and 33.

Table 31. Value h/d and k.

$\frac{h}{d}$	k	$\frac{h}{d}$	k	$\frac{h}{d}$	k	$\frac{h}{d}$	k	$\frac{h}{d}$	k
0,02	0,006	0,22	0,163	0,42	0,339	0,62	0,651	0,82	0,878
0,04	0,013	0,24	0,185	0,44	0,424	0,64	0,676	0,84	0,897
0,06	0,025	0,26	0,207	0,46	0,449	0,66	0,7	0,86	0,914
0,08	0,038	0,28	0,229	0,48	0,475	0,68	0,724	0,88	0,932
0,1	0,052	0,3	0,252	0,5	0,5	0,7	0,748	0,9	0,948
0,12	0,069	0,32	0,276	0,52	0,526	0,72	0,771	0,92	0,963
0,14	0,085	0,34	0,3	0,54	0,551	0,74	0,793	0,94	0,976
0,16	0,103	0,36	0,324	0,56	0,576	0,76	0,816	0,96	0,987
0,18	0,122	0,38	0,349	0,58	0,601	0,78	0,837	0,98	0,995
0,2	0,142	0,4	0,374	0,6	0,625	0,8	0,858	1	1

Example. Volume of horizontal cylindrical container $V_c = 10{,}85\ m^3$ with bore d=1.2 m and at length l =9.6 m. The height of the layer of liquid is h=0.88 m; value $\frac{h}{d} = \frac{0{,}88}{1{,}2} = 0{,}733$.

Through Table 31 we find value k as the average between 0.771 and 0.793 (for h/d=0.72 and h/d=0.74): k=0.785. We determine from formula the volume of the liquid: $V_ж = 10{,}85 \cdot 0{,}785 = 8{,}52\ m^3$.

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Table 32. Volume of water 1 m of duct in l.

$D_н$, мм	(1) Толщина стенки трубы в мм													
	2	2,5	3	3,5	4	4,5	5	6	8	10	12	14	16	18
14	0,154	0,133	0,113	0,095	0,079	—	—	—	—	—	—	—	—	—
25	0,346	0,314	0,284	0,254	0,227	0,201	0,177	0,133	—	—	—	—	—	—
32	0,616	0,573	0,531	0,491	0,452	0,415	0,38	0,314	0,201	—	—	—	—	—
38	0,908	0,855	0,804	0,755	0,707	0,661	0,616	0,531	0,38	—	—	—	—	—
45	1,32	1,256	1,195	1,134	1,075	1,018	0,962	0,855	0,661	0,491	—	—	—	—
57	2,206	2,124	2,043	1,963	1,886	1,809	1,735	1,59	1,32	1,075	0,855	—	—	—
76	4,071	3,959	3,848	3,739	3,631	3,526	3,421	3,217	2,827	2,463	2,124	1,81	—	—
89	5,674	5,542	5,411	5,281	5,153	5,027	4,902	4,657	4,185	3,739	3,318	2,922	2,552	—
108	8,495	8,332	8,171	8,012	7,854	7,698	7,543	7,238	6,648	6,082	5,542	5,027	4,536	4,071
133	—	12,87	12,67	12,47	12,27	12,08	11,88	11,5	10,75	10,03	9,331	8,659	8,012	7,39
159	—	18,63	18,38	18,15	17,91	17,67	17,44	16,97	16,06	15,17	14,31	13,48	12,67	11,88
219	—	—	—	35,3	34,97	34,64	34,31	33,65	32,37	31,1	29,86	28,65	27,46	26,3
273	—	—	—	—	55,15	54,74	54,32	53,5	51,87	50,27	48,69	47,14	45,62	44,11
325	—	—	—	—	—	78,43	77,93	76,94	74,99	73,06	71,16	69,28	67,43	66,6
377	—	—	—	—	—	106,4	105,8	104,6	102,4	100,1	97,87	95,66	93,48	91,33
426	—	—	—	—	—	136,6	135,9	134,6	132	129,5	126,9	124,4	121,9	119,5
530	—	—	—	—	—	—	212,4	210,7	207,5	204,3	201,1	197,9	194,8	191,7
630	—	—	—	—	—	—	301,9	300	296,1	292,2	288,4	284,6	280,9	277,1
720	—	—	—	—	—	—	395,9	393,7	389,3	384,8	380,5	376,1	371,8	367,5
820	—	—	—	—	—	—	515,3	512,8	507,7	502,7	497,6	492,7	487,7	482,7
920	—	—	—	—	—	—	650,4	647,5	641,8	636,2	620,2	624,9	619,3	613,8
1020	—	—	—	—	—	—	801,2	798	791,7	785,4	779,1	772,9	766,7	760,5
1120	—	—	—	—	—	—	—	964,2	957,3	950,3	913,4	936,6	929,7	922,9
1220	—	—	—	—	—	—	—	—	—	1131	1123,4	1116	1108,5	1101
1420	—	—	—	—	—	—	—	—	—	1539,4	1530,6	1521,8	1513,1	1504,4
1620	—	—	—	—	—	—	—	—	—	2010,6	2000,6	1990,6	1980,6	1970,7

Key: (1). The wall thickness of duct in mm.

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Table 33. Area of duct according to outside diameter and surface 1 m of duct.

$D_н$, мм	(1) Площадь трубы по наружному диаметру в см²	(2) Поверхность 1 м трубы в м²	$D_н$, мм	(1) Площадь трубы по наружному диаметру в см²	(2) Поверхность 1 м трубы в м²	$D_н$, мм	(1) Площадь трубы по наружному диаметру в см²	(2) Поверхность 1 м трубы в м²
18	2,515	0,057	133	138,9	0,416	720	4 071	2,262
25	4,909	0,079	159	198,6	0,5	820	5 281	2,576
32	8,042	0,1	219	376,7	0,688	920	6 648	2,890
38	11,34	0,119	273	585,3	0,858	1020	8 171	3,204
45	15,9	0,141	325	829,6	1,021	1120	9 852	3,519
57	25,52	0,179	377	1116	1,184	1220	11 690	3,833
76	45,36	0,239	426	1425	1,338	1420	15 837	4,461
89	62,21	0,28	530	2206	1,665	1620	20 612	5,089
108	91,61	0,339	630	3117	1,979			

Key: (1). Area of duct according to outside diameter in cm³. (2). Surface 1 m of duct in m².

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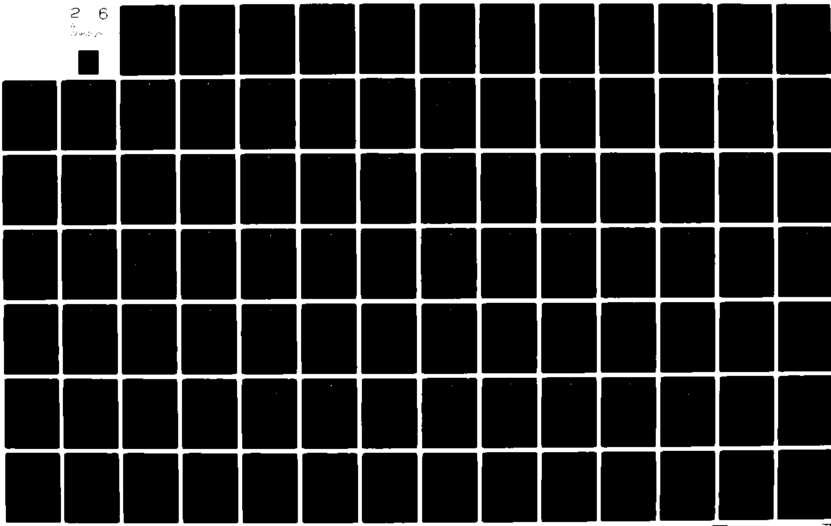

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Chapter II.

STEEL TUBES.

§1. General information.

Ducts for technological pipelines classify according to the forms of the materials, used for their manufacture, and using production methods.

According to the forms of materials the ducts divide into metallic ones and nonmetallic ones.

According to production method the metal tubes divide into jointless ones, welded ones and poured.

Jointless steel tubes are prepared hot-rolled, cold-rolled, and cold-drawn.

The geometric manufacturing precision and the finish of the surface of the cold-drawn and cold-rolled ducts are higher than the

ducts of hot-rolled ones.

Ducts of carbon steel use for the transporting nonaggressive and slightly agressive products at temperature not more than 450°C.

For the transporting of high and moderately aggressive products whose motion along carbide ducts can cause their corrosion and change in the quality, and also for a work at temperatures higher than 450°C are used ducts of alloy and high-alloy steel.

The allowable internal pressure in steel tubes depends mainly on the brand/mark of steel, of the wall thickness of duct and on the quality of heat treatment. At present produce the steel tubes, calculated to pressure 2500 kg/cm² and above.

The assortments of steel tubes for technological pipelines encompass range in diameter from 1 to 1600 mm in wall thickness from 0.1 to 75 mm, which gives the possibility of the wide selection of ducts in connection with the varied conditions for work.

Seamless pipes are most good-quality; therefore them are used for the pipelines of the critical/heavy-duty designation/purpose (I and II category), which transport acids, alkalis, toxic, choking, fire- and dangerously explosive products, liquefied gases independent

of the operating pressure; for steam lines, air ducts and lines of inert gases at a conventional pressure of above 16 kg/cm²; for pressure piping, etc.

Seamless pipes made of corrosion-resistant steel according to GOST 9940-72 and 9941-72 are intended for the transport of high-corrosion chemical products, sulfurous liquid and gaseous petroleum products, and also for steam lines with high ones by temperature and pressure of steam. Especially use extensively ducts of chrome-nickel steel the brands/marks Kh18N10T, which possess high chemical and temperature durability. Corrosion-resistant seamless pipes in accordance with GOST are prepared by outside diameter to 325 mm. With pipe laying of large-diameter are used the noncorrosive electric welding (from sheet) ducts.

Electric welding ducts according to GOST 10704-63 and 10707-63 usually use for manufacturing the pipelines, which transport combustible, nonagressive and slightly agressive products, alkalis, overheated and saturated steam at a conventional pressure not more than 16 kg/cm² and to temperature of 300°C.

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Steel welded water-gas conducting ducts according to GOST

3262-62 are used for intrashop water supply lines, heating pipelines, lines of compressed air, and also other pipelines of V category.

Water-gas conducting usual ducts are calculated for pressure to 10 kg/cm², but the intensive, characterized by greater thickness walls, to pressure to 16 kg/cm². Greatest permissible temperature for these ducts of 200°C.

Steel cracking communication ducts (GOST 550-58) are produced on assortment GOST 8732-70 and 8734-58. Ducts for the transport of products of petroleum refining at temperatures from -70 to +570°C are used depending on the trademark of steel from which they are manufactured.

In accordance with designation/purpose and conditions the work of duct on manufacturing plant must on the demand of customer undergo different technological tests, by the caused standards for the ducts (see §2, chapter I).

The fundamental characteristics of the steel tubes, used for technological pipelines, are given in Table 1.

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Table 1. Characteristic of steel tubes.

(1) Наименование труб	ГОСТ	$D_н$, мм	S, мм	(2) Наименование стали	(3) № таблицы в данной главе
(4) Стальные бесшовные горячекатаные	8732—70 (5) (сортамент), 8731—66 (технические требования)	25—820	2,5—75	(6) Углеродистая по ГОСТ 380—71 и 1050—60, легированная по ГОСТ 4543—71 и 5058—65	8—10
(7) Стальные бесшовные холоднотянутые и холоднокатаные	8734—58** (5) (сортамент), 8733—66 (технические требования)	1—200	0,1—12	(6) Углеродистая по ГОСТ 380—71 и 1050—60, легированная по ГОСТ 4543—71 и 5058—65	(6a) 8 и 9
(8) Стальные прецизионные: (8a) после холодного передела (8b) горячекатаные	9567—60* (5) (сортамент), 8733—66 и 8731—66 (технические требования)	 4—710 25—325	 0,1—32 2,5—20	(6) Углеродистая по ГОСТ 380—71 и 1050—60, легированная по ГОСТ 4543—71 и 5058—65	8—10
(9) Стальные крекинговые: (9a) печные и теплообменные (9b) коммуникационные: (9c) горячекатаные (9d) холоднотянутые и холоднокатаные	550—58	 19—219 25—820 1—200	 1,5—25 2,5—75 0,1—12	(11) Углеродистая по ГОСТ 1050—60, легированная по ГОСТ 4543—71, 10500—63 и 5632—61*	(6a) 8 и 11
(10) Бесшовные горячедеформированные из коррозионностойкой стали	9940—72	57—325	3,5—32	(11) Высоколегированная по ГОСТ 5632—61*	(6a) 12 и 14
(12) Бесшовные холодно- и теплодеформированные из коррозионностойкой стали	9941—72	5—250	0,2—22	То же (12a)	(6a) 13 и 14
(13) Бесшовные особотонкостенные из коррозионностойкой стали	10498—63	4—120	0,2—1	(11) Высоколегированная по ГОСТ 10498—63	(6a) 15 и 16
(14) Бесшовные биметаллические	10192—62*	6—370	1,5—10	(15) Углеродистая по ГОСТ 1050—60 и медь по ГОСТ 859—66	17
(16) Стальные электросварные	10704—63* (5) (сортамент), 10705—63* и 10706—63 (технические требования)	8—1620	1—16	(6) Углеродистая по ГОСТ 380—71, 500—58 и 8597—57, легированная по ГОСТ 1050—60	8, 18, 19
(17) Стальные электросварные холоднотянутые и холоднокатаные	10707—63, 8733—66 (технические требования) (18)	5—76	0,5—3	(19) Углеродистая по ГОСТ 380—71 и 1050—60	(6c) 8 и 9
(20) Стальные электросварные по спиральным швам	8696—62	426—1220	4—12	(6) Углеродистая по ГОСТ 380—71, легированная по ГОСТ 5058—65	8
(21) Электросварные из коррозионностойкой стали	11068—64	8—102	1—4	(11) Высоколегированная по ГОСТ 5632—61 *	8, 20
(22) Стальные водогазопроводные (легкие, обыкновенные и усиленные)	3262—62	10,2—165	1,8—5,5	(23) Углеродистая по ГОСТ 380—71	21

Key: (1). Designation of ducts. (2). Designation of steel. (3). No of

table in this chapter. (4). Round jointless hot-rolled. (5). assortment), 8731-66 (technical requirements). (6). Carbide according to GOST 380-71 and 1050-60, alloyed according to GOST 4543-71 and 5058-65. (6a). and. (7). Steel jointless cold-drawn and cold-rolled. (8). Steel Precision. (8a). after cold repartition/conversion. (8b). hot-rolled. (9). Steel cracking. (9a). furnace and heat exchange. (9b). communication. (9c). hot-rolled. (9d). cold-drawn and cold-rolled. (10). Seamles hot-deformed made of corrosion-resistant steel. (11). Highly alloyed on. (12). Jointless cold and hot worked made of corrosion-resistant steel. (12a). then. (13). Jointless especially thin-walled made of corrosion-resistant steel. (14). Seamless bimetallic. (15). Carbide according to GOST 1050-60 and copper according to GOST 859-66. (16). Steel electric welding. (17). Steel electric welding cold-drawn and cold-rolled. (18). technical requirements. (19). Carbide according to GOST 380-71 and 1050-60. (20). Steel electric welding on spiral welds. (21). Electric welding made of corrosion-resistant steel. (22). Steel water-gas conducting (light, usually strengthened). (23). Carbide according to.

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§2. Limiting assortments of ducts.

The limiting assortments of ducts for technological pipelines

are installed for the purpose of the decrease of a quantity of the sizes/dimensions of ducts used. They are regulated by the standards of machine-building MN 2566-61 and MN 4705-63 to ducts made of carbon and alloy steels on P_y to 100 kg/cm².

Limiting assortments encompass jointless, electric welding and water-gas lines of carbon and alloy steels with the internal diameters from 6 to 1600 mm.

Wall thickness is determined by project, on the basis of temperature conditions, pressures and degree of the aggressiveness of transported products.

In accordance with the "norms of the calculation of the elements/cells of steam boilers to strength", affirmed Gosgortekhnadzor of the RSFSR on 26 March 1965, and "instructions on the calculation of the steel pipelines of different designation/purpose" (SN 373-67), affirmed by GOSSTROY of the USSR on 22 July 1967, by ministries of Chemical industry of the USSR, petroleum refining and petrochemical Industry of the USSR and installation and special construction work of the USSR is released and put into operation from 1 January 1968 limiting assortment on jointless and electric welding ducts for technological pipelines on P_y to 100 kg/cm² made of carbon steel and steel of brand 10G2 (MSN 106-68/MMSS of the USSR (Table 2 and 3).

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1. Limiting assortment of ducts made of carbon steel.

Table 2. Sizes/dimensions of seamless pipes in mm (GOST 8732-70 and 8734-58**) of the group of delivery A for products from $t_{раб}$ from -70 to +450°C (MSN 106-68/MMSS of the USSR).

D_y	$D_н$	(1) Толщина стенки труб S					
		(2) для неагрессивных и малоагрессивных продуктов			(3) для среднеагрессивных продуктов		
		P_y, кгс/см² (4)					
		<40	<64	<100	<40	<64	<100
10	14	1,6	1,6	1,6	3	3	3
15	18	1,6	1,6	1,6	3	3	3
[illegible]	25	1,6	1,6	1,6	3	3	3
[illegible]	32	2	2	2	3,5	3,5	3,5
[illegible]	[illegible]	2	2	2	4	4	4
[illegible]	45	2,5	2,5	2,5	4	4	4
[illegible]	57	[illegible]	3,5	3,5	5	5	5
[illegible]	[illegible]	[illegible]	3,5	4,5	4,5	6	6
[illegible]	[illegible]	[illegible]	[illegible]	4,5	4,5	6	6
100	108	4	4	6	5	7	7
125	133	4	4	7	7	7	9
150	159	4,5	6	8	6	8	10
200	219	7	7	10	7	10	12
250	273	8	8	14	8	12	14
300	325	8	10	16	10	14	16
350	377	9	12	18	12	14	18
400	426	10	14	—	12	14	—

Key: 1) Thickness of the walls of pipes S. 2) for nonaggressive and slightly aggressive products. 3) for moderately aggressive products. 4) kgf/cm².

Notes: 1. Material rub: for nonagressive and slightly agressive products - steel of brand 20 according to GOST 1050-60 for pipelines with operating temperature from -40 to +450°C and steel of brand 10G2 for ducts $D_н$< 219 мм according to GOST 4543-71 for pipelines with

operating temperature from -41 to -70°C; for moderately aggressive products - steel of brand 20 according to GOST 1050-60 for pipelines with operating temperature from -40 to +300°C.

2. At discretion of planning organization is permitted use/application of ducts from steel of brand 10 according to GOST 1050-60 and brands/marks St.2sp and St.4sp according to GOST 380-71 for pipelines with permissible parameters of transported products.

Key: (1). The wall thickness of ducts S. (2). for nonagressive and slightly agressive products. (3). for moderately aggressive products. (4). kg/cm².

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Table 3. Sizes/dimensions of electric welding ducts in mm (GOST 10704-63* and 10705-63*) of the group of delivery A (GOST 10704-63* and 10706-63) and group of delivery B for products from $t_{раб}$ from -30 to +300°C (MSN 186-68/MMSS USSR).

D_y	$D_н$	(1) Толщина стенки труб S для неагрессивных и малоагрессивных продуктов на P_y в кгс/см²		
		<10	<16	<25
10	14	1,6	1,6	1,6
15	18	2	2	2
20	25	2	2	2
32	38	2	2	2
40	45	2	2	2
50	57	3	3	3
65(70)	76	3	3	3
80	89	3	3	3
100	108	3	3	3
100	114	4	4	4
150	159	4,5	4,5	4,5
200	219	6	6	6
250	273	7	7	7
300	325	7	7	7
400	426	7	7	7
500	530	7	7	8
600	630	7	7	10
700	720	8	8	12
800	820	8	8	12
900	920	8	8	14
1000	1020	9	10	—
1100	1120	9	11	—
1200	1220	9	12	—
1400	1420	10	14	—

Note. Material of the ducts: for $D_н$<426 mm - steel of brand 20 according to GOST 1050-60* and VSt.3sp according to GOST 380-71; for $D_н$>530 - steel of the brands/marks St.3sp and VSt.3sp according to GOST 380-71.

Key: (1). The wall thickness of ducts S for nonagressive and slightly agressive products on P_y in kg/cm².

Table 4. Sizes/dimensions electric welding of ducts with spiral weld in mm (GOST 8696-62) for products with operating temperature to 300°C (SN 2566-61).

D_y	$D_н$	(1) Толщина стенки труб S для неагрессивных и малоагрессивных продуктов на P_y в кгс/см²	
		≤ 10	≤ 16
400	426	4	5
450	480	4	6
500	530	5	6
600	630	6	7
700	720	6	8
800	820	6	8
900	920	8	8
1000	1020	8	9

Note. the material of ducts - steel of brand/mark St.3 or VSt.3 according to GOST 380-71.

Key: (1). The wall thickness of ducts S for nonagressive and slightly agressive products on P_y in kgf/cm³.

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Table 5. Sizes/dimensions of water-gas conducting ducts in mm (GOST 3262-62) for products with operating temperature to 200°C (NN 2566-61).

D_y	$D_н$	(1) Толщина стенки труб S для неагрессивных и малоагрессивных продуктов на P_y в кгс/см²	
		<10	<16
8	13,5	2,2	2,8
10	17	2,2	2,8
15	21,3	2,8	3,2
20	26,8	2,8	3,2
25	33,5	3,2	4
32	42,3	3,2	4
40	48	3,5	4
50	60	3,5	4,5
70	75,5	4	4,5
80	88,5	4	4,5
100	114	4,5	5

Note. Material of ducts - steel according to GOST 380-71.

Key: (1). The wall thickness of ducts S for nonagressive and slightly agressive products on P_y in kgf/cm².

2. Limiting assortment of ducts made of alloy steel (NN 4705-63).

Table 6. Sizes/dimensions of cracking communication ducts in mm (GOST 550-58).

D_y	$D_н$	(1) Толщина стенки труб S для продуктов																
		(2) неагрессивных и малоагрессивных					(3) агрессивных											
		(4) марка стали (ГОСТ 5632—61*)																
		12ХМФ		Х5, Х5М, Х5ВФ, Х8ВФ		Х5М-У	12ХМФ				Х5, Х5М, Х5ВФ, Х8ВФ				Х5М-У			
		P_y, кгс/см² (5)																
		≤64	≤100	≤64	≤100	≤100	≤25	≤40	≤64	100	≤25	≤40	≤64	100	≤40	≤64	100
10	14	1,6	1,6	1,6	1,6	—	3	3	3	3	3	3	3	3	—	—	—
15	18	1,6	1,6	1,6	1,6	—	3	3	3	3	3	3	3	3	—	—	—
20	25	1,6	1,6	1,6	1,6	—	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	—	—	—
25	32	2	2	2	2	—	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	—	—	—
32	38	2	2	2	2	—	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	—	—	—
40	45	2,5	2,5	2,5	2,5	—	3,5	3,5	3,5	3,5	3,5	3,5	3,5	3,5	—	—	—
50	57	3	3	3	3	—	3	3	5	5	3	3	5	5	—	—	—
70	76	3,5	3,5	3,5	3,5	—	3,5	3,5	5	5	3,5	3,5	5	5	—	—	—
80	89	3,5	3,5	3,5	4,5	—	3,5	4,5	6	7	3,5	4,5	6	7	—	—	—
100	108	4	4	4	4,5	—	4	4,5	6	8	4	4,5	6	8	—	—	—
125	133	4	5	4	6	4	4	6	7	9	4	6	7	9	4	5	7
150	159	4,5	6	4,5	7	4,5	4,5	6	8	10	4,5	7	8	10	4,5	6	8
175	194	6	7	6	8	6	6	7	9	10	6	8	9	12	6	7	9
200	219	7	8	7	9	7	7	8	10	11	7	9	10	14	7	7	10
250	273	7	9	8	12	8	7	9	12	14	8	9	12	16	8	8	12
300	325	9	12	9	14	10	9	9	12	16	9	9	14	18	10	10	14
350	377	10	12	12	16	12	10	10	14	18	12	12	16	20	12	12	16
400	426	11	14	12	18	12	11	11	16	20	12	12	18	22	12	12	16
450	465	—	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Notes: 1. Steel of brand Kh5M-U - heat-treated steel is brand Kh5M.

2. Ducts made of steel of brand Kh8PF - on TSFM 5580-58.

Key: (1). The wall thickness of ducts S for products. (2). nonagressive and slightly agressive. (3). agressive. (4). trademark of steel. (5). kgf/cm².

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§3. Assortments of steel tubes.

The assortments of the most frequently used jointless and electric welding ducts made of carbon and alloy steels are given in Table 8, which encompasses seamless pipes according to GOST 8732-70, 8734-58**, 9567-60*, 550-58 and electric welding according to GOST 10704-63* and 10707-63. Mass 1 lin. m of duct are determined from to the formula

$$G = \frac{\pi}{1000} \rho S (D_{н} - S) \text{ кг } \quad (1)$$

Key: (1). kg.

where ρ - density of carbon steel, equal to 7.85; S - wall thickness in mm; $D_{н}$ - outside diameter in mm.

During the determination of the mass of ducts made of alloy steels of different brands/marks the corresponding to them density should be accepted according to Table 10, Chapter I.

For electric welding straight-seamed ducts according to GOST 10706-63 the mass of 1 linear meter ~~[illegible]~~ it is necessary to increase against the values, placed in Table 8 by 1%, and ~~[illegible]~~ for ducts with spiral weld - according to GOST 8696-62 [illegible] weld reinforcement.

Table 7. Sizes/dimensions of ducts made of corrosion-resistant steel in mm (GOST 9940-72 and 9941-72).

D_y	$D_н$	(1) Толщина стенки труб S для продуктов				
		(2) неагрессивных и малоагрессивных		(3) агрессивных		
		P_y, кгс/см² (4)				
		<64	<100	<40	<64	<100
10	14	1,4	1,4	2,5	2,5	2,5
15	18	1,4	1,4	2,5	2,5	2,5
20	25	1,4	1,4	2,5	2,5	2,5
25	32	1,6	1,6	2,5	2,5	2,5
32	38	2	2	3	3	3
40	45	2	2,5	2,5	2,5	3,5
50	57	2	3	3	4	4
70	76	2,5	3,5	3,5	3,5	5
80	89	3	4,5	4,5	4,5	6
100	108	3,5	4,5	4,5	4,5	7
125	133	5	6	5	6	8
150	159	6	7	6	7	9
175	194	9	9	9	9	11
200	219	10	10	10	10	12
250	273	11	12	11	12	14
300	325	12	14	12	14	—

Note. the material of the ducts: steel of the brands/marks Kh18N10T, Kh17N13M2T, 0Kh17N16M3T, 1Kh21N5T, 0Kh21N5T, 0Kh23N18, Kh17, Kh28, Kh25T according to GOST 5632-61*.

Key: (1). The wall thickness of ducts S for products. (2). nonagressive and slightly agressive. (3). agressive. (4). kgf/cm².

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§4. Techical requirements for the delivery of steel tubes.

1. Ducts steel jointless hot-rolled (GOST 8731-66, 8732-70).

Assortment and mass are given in Tables 8.

Depending on designation/purpose and guaranteed characteristics the ducts supply by the following groups:

A - by the chemical composition made of steel of brands/marks according to GOST 1050-60**, 4543-71, 5058-65* and 380-71 (see Table 2, 4, 6, 8 of chapter I) and according to mechanical properties (Table 9 and 10);

B - by the chemical composition without the control of mechanical properties made of killed steel of brands/marks according to GOST 380-71, 1050-60**, 4543-71 and 5058-65* (see Tables 2, 4, 6 and 8 of chapter I);

C - according to mechanical properties made of killed steel of brands/marks according to GOST 380-71 (group A) according to requirements indicated in Tables 9 and 10;

D - by the chemical composition made of steel of brands/marks according to GOST 1050-60**, 4543-71 and 5058-65* (see Table 4, 6, 8 of chapter I) with the control of mechanical properties in the

heat-treated samples/specimens according to norms, indicated in the standards;

E - without the standardization of the chemical composition and mechanical properties on with the guarantee of testing hydraulic pressure.

Table 8. Assortment of steel jointless and electric welding ducts.

D_y, мм	$D_н$, мм	(1) Толщина стенки									
		1,4	1,8	2	2,5	3	3,5	4	4,5	5	6
		(2) Масса 1 пог. м									
10	14	0,434	0,541	0,592	0,709	0,814	0,906	0,986	—	—	—
15	18	0,572	0,717	0,789	0,956	1,11	1,25	1,38	1,5	1,6	—
20	25	0,813	1,03	1,13	1,39	1,63	1,86	2,07	2,28	2,47	2,81
25	32	1,053	1,34	1,48	1,76	2,15	2,46	2,76	3,05	3,33	3,85
32	38	1,26	1,61	1,78	2,19	2,59	2,98	3,35	3,72	4,07	4,74
40	45	1,51	1,91	2,12	2,62	3,11	3,58	4,04	4,49	4,93	5,77
50	57	1,92	2,45	2,71	3,36	4	4,62	5,23	5,83	6,41	7,55
65(70)	76	2,57	3,29	3,65	4,53	5,4	6,26	7,1	7,93	8,75	10,36
80	89	3,02	3,86	4,29	5,33	6,36	7,38	8,38	9,38	10,36	12,28
100	108	3,67	4,72	5,23	6,5	7,77	9,02	10,26	11,49	12,7	15,09
100	114	—	—	—	6,87	8,21	9,54	10,85	12,15	13,44	15,98
125	133	—	—	—	8,05	9,59	11,18	12,75	14,26	15,78	18,79
150	159	—	—	—	9,65	11,54	13,42	15,29	17,15	18,99	22,64
175	194	—	—	—	—	—	16,44	18,74	21,03	23,31	27,82
200	219	—	—	—	13,35	15,98	18,6	21,21	23,8	26,39	31,52
250	273	—	—	—	16,68	19,97	23,25	26,53	29,8	33,04	39,51
300	325	—	—	—	19,88	23,82	27,75	31,66	35,57	39,46	47,2
350	377	—	—	—	23,09	27,67	32,24	36,79	41,34	45,86	54,89
400	426	—	—	—	26,11	31,28	36,36	41,63	46,77	51,91	62,14
450	480	—	—	—	29,44	35,29	41,13	46,95	52,77	58,57	70,13
500	530	—	—	—	32,52	38,99	45,44	51,88	58,31	64,73	77,53
600	630	—	—	—	—	46,39	54,07	61,75	69,41	77,06	92,33
700	720	—	—	—	—	—	—	—	—	88,17	105,7
800	820	—	—	—	—	—	—	—	—	100,5	120,5
900	920	—	—	—	—	—	—	—	—	112,8	136,2
1000	1020	—	—	—	—	—	—	—	—	125,2	150
1100	1120	—	—	—	—	—	—	—	—	—	164,8
1200	1220	—	—	—	—	—	—	—	—	—	179,6
1400	1420	—	—	—	—	—	—	—	—	—	[illegible],2
1600	1620	—	—	—	—	—	—	—	—	—	—

Table 8 cont.

S, мм											
7	8	9	10	11	12	14	16	18	20	22	25
труб в кг											
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
3,11	3,36	—	—	—	—	—	—	—	—	—	—
4,32	4,74	—	—	—	—	—	—	—	—	—	—
5,36	5,92	6,44	—	—	—	—	—	—	—	—	—
6,56	7,3	7,99	8,63	—	—	—	—	—	—	—	—
8,63	9,67	10,66	11,59	12,48	13,32	—	—	—	—	—	—
11,91	13,42	14,87	16,28	17,63	18,94	21,41	23,68	25,75	—	—	—
14,16	15,98	17,76	19,48	21,16	22,79	26,89	28,8	31,52	34,03	36,35	—
17,44	19,73	21,97	24,17	26,31	28,41	32,45	36,3	39,95	43,4	46,66	51,17
18,47	20,91	23,31	25,65	27,94	30,19	31,53	38,67	42,62	46,36	49,81	54,87
21,76	24,65	27,82	30,33	33,1	33,81	41	46,17	51,65	55,73	60,22	66,59
26,24	29,79	33,29	36,75	40,15	43,5	50,06	56,43	62,59	68,56	74,33	82,62
32,28	36,7	41,06	45,39	49,64	53,86	62,15	70,24	78,13	85,28	93,32	104,19
36,6	41,63	46,61	51,54	55,43	61,26	70,78	80,1	89,23	98,15	106,88	119,61
45,92	52,28	58,6	64,86	71,07	77,24	89,42	101,41	113,2	124,79	136,18	152,9
54,89	62,54	70,14	77,68	85,18	92,63	107,38	121,93	136,28	150,44	164,39	184,96
63,87	72,8	81,68	90,51	99,29	108,02	125,33	142,44	159,36	176,08	192,61	217,02
72,33	82,46	92,55	102,59	112,58	122,52	142,25	161,78	181,11	200,25	219,19	247,23
81,65	93,12	104,62	115,9	127,22	138,49	160,88	183,08	205,07	226,87	248,47	280,51
90,28	102,98	115,62	128,93	140,78	153,28	178,14	202,8	227,27	251,53	275,6	311,53
107,54	122,71	137,81	152,89	167,91	182,88	212,67	242,26	271,65	300,86	329,86	372,98
123,1	140,5	157,8	175,1	192,3	209,5	243,74	277,77	—	—	—	—
140,3	160,2	180	199,8	219,5	239,1	278,3	317,3	—	—	—	—
157,6	179,9	202,2	224,4	246,6	268,7	312,8	356,7	—	—	—	—
174,9	199,7	224,4	249,1	273,7	298,3	347,3	396,2	—	—	—	—
192,1	219,4	246,6.	273,7	300,8	327,9	381,9	435,6	—	—	—	—
209,4	239,1	268,8	298,4	328	357,5	416,4	475,1	—	—	—	—
243,9	278,6	313,2	347,7	382,2	416,7	485,4	554	—	—	—	—
—	—	—	397,1	436,5	475,9	554,5	632,5	—	—	—	—

Key: (1). Thickness of wall S, mm. (2). Mass of 1 lin. m of ducts in kg.

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2. Ducts steel jointless cold-drawn and cold-rolled (GOST 8733-66, 8734-58**).

Depending on their purpose and guaranteed characteristics, the ducts [pipes] ~~[illegible]~~ are divided into the following groups:

A - by the chemical composition - made of steel of brands/marks on GOST 1050-60**, 4543-71, 5058-65* (see Tables 4, 6 and 8 of chapter I) and according to mechanical properties (Table 9);

B - by the chemical composition without the control of mechanical properties - made of killed steel of brands/marks according to GOST 380-71, 1050-60**, 4543-71 and 5058-65* (see Tables 2, 4, 6 and 8 of chapter I);

C - by the chemical composition - made of steel of brands/marks according to GOST 1050-60**, 4543-71* and 5058-65* (see Tables 4, 6 and 8 of chapter I) with the control of mechanical properties in the heat-treated samples/specimens according to the norms, indicated in

the standards;

D - after special heat treatment. The trademarks of steel, the mode/conditions of heat treatment and norm of mechanical properties are established by the technical specifications;

E - without the standardization of the chemical composition and mechanical properties, but with the guarantee of testing hydraulic pressure.

Table 9. Mechanical properties the seamless pipes of group A (GOST 8731-66 and 8733-66).

(1) Марка стали	$\sigma_т$	$\sigma_в$	δ_5, %	(2) Твердость по Бринеллю (при толщине стенки более 10 мм)	
	(3) кгс/мм²			(5) диаметр отпечатка в мм, не менее	(6) число твердости, не более
	(4) не менее				
10	21	34	24	5,1	137
20	25	42	21	4,8	156
35	30	52	17	4,4	187
45	33	60	14	4,2	207
10Г2	27/25	48/43	21/22	4,3	197
15Х	—	42	19	4,5	179
20Х	—	44	16/17	—/4,5	—/179
40Х	—	67/63	9/14	3,7/4,1	269/217
30ХГСА	—	70/50	11/18	—/4	—/229
15ХМ	23	44	21	—	—
30ХМА	40	60	13	—	—
12ХН2	40	55	14	—	—
ВСт.4сп	25	42	20	—	—
ВСт.5сп	27	50	17	—	—

Notes: 1. In numerator are given the data along hot-rolled ducts, in denominator - on that cold-drawn and cold-rolled ones.

2. From steel brands 15Kh prepare only cold-drawn and cold-rolled ducts.

3. From steel of brands 30KhMA and 12KhN2, and also VSt.4sp and VSt.5sp are prepared only hot-rolled ducts.

4. Mechanical properties of ducts from other brands/marks of steels, and also norm of impact viscosity and relative reduction of area are established by agreement of sides.

5. Mechanical properties of hot-rolled ducts are given in as-received condition, and cold-rolled and cold-drawn - after heat treatment.

Key: (1). Trademark of steel. (2). Hardness according to Brinell (with wall thickness more than 10 mm). (3). kg/mm². (4). it is not less. (5). diameter of impression in mm, is not less. (6). hardness number, is not more.

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Depending on designation/purpose, conditions the work of pipelines and demands of the customers of duct on manufacturing plant undergo the following tests: hydraulic, for distribution, for knee, for flattening, for flanging, for stretching, for the hardness (see Chapter I, §2).

3. Ducts steel precise (GOST 9567-60*).

Assortment and mass are given in Table 8.

Ducts precise ones (increased manufacturing precision) supply after cold repartition/conversion and hot rolling. Material and technical requirements by the chemical composition (see Tables 2, 4, 6 and 8 of chapter I), the mechanical properties (Tables 9 and 10) and to the tests of ducts after cold repartition/conversion must correspond to GOST 8733-66, but hot-rolled - GOST 8731-66.

4. Ducts steel cracking (GOST 550-58).

Assortment and mass are given in Table 8.

The chemical composition of cracking ducts made of steel of brands 10 and 20 must correspond to GOST 1050-60**; brands Kh5, Kh5M and Kh5VF - GOST 5632-61*; brand 10G2 - GOST 4543-71; brands 12MKh and 12KhMVF - GOST 10500-63 (see Tables 4, 8 and 10 of chapter I).

The mechanical properties of ducts in as-received condition must conform to those ~~[illegible]~~ in Table 11.

Table 10. Mechanical properties of the jointless hot-rolled ducts of group B (GOST 8731-66).

(1) Марка стали	$\sigma_т$	$\sigma_в$	δ_5, %
	(2) кгс/мм²		
	(3) не менее		
(4) Ст.2сп	21	34	24
(4) Ст.4сп	26	42	20
(4) Ст.5сп	27	50	17
(4) Ст.6сп	30	60	14

Key: (1). the trademark of steel. (2). kg/mm². (3). it is not less. (4). St.2sp.

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The supplied ducts on manufacturing plant they test/experience to distribution, flattening, stretching, impact toughness, hardness and subject to hydraulic pressure (see Chapter I, §2).

5. Ducts jointless made of corrosion-resistant steel, hot-deformed (GOST 9940-72), cold and hot worked (GOST 9941-72).

The assortment of the most frequently used seamless pipes made of corrosion-resistant steel is given in Tables 12, 13.

Ducts jointless ones of corrosion-resistant steel produce made

of steel of the brands/marks, indicated in Table 14.

Ducts according to GOST 9941-72 must be supplied in the heat-treated state; according to GOST 9940-72 heat treatment of ducts is accomplished/realized on the demand of consumer.

The chemical composition of the trademarks of steels is given in Table 10, chapter I; the mechanical properties of ducts in as-received condition must correspond to those indicated in Table 14.

Depending on the demands of the customers the manufacturing plant produces the tests of ducts for distribution, flattening, stretching, hydraulic pressure and intercrystalline corrosion (see §2, chapter I).

Table 11. Mechanical properties of cracking steel tubes (GOST 550-58).

(1) Трубы по состоянию материала при поставке	(2) Марка стали	$\sigma_в$	$\sigma_т$	δ_5	ψ	(4) $a_н$, кгс·м/см²	(5) Твердость по Бринеллю HB: (6) диаметр отпечатка в мм	(7) число твердости
		(3) кгс/мм²		%				
		(8) не менее						(9) не более
(10) Горячекатаные без отжига	10	36	22	25	50	8	5,1	137
	10Г2	48	27	21	50	12	4,3	197
	20	44	26	22	50	8	4,8	156
(11) Холоднотянутые или холоднокатаные после отжига	10	34	20	26	50	8	5,1	137
	20	42	24	23	50	8	4,8	156
(12) После отжига	12MX	42	25	21	45	7	4,8	156
	X5	40	22	24	50	10	4,6	170
	X5M	40	22	22	50	12	4,6	170
	X5ВФ	40	22	22	50	12	4,6	170
	12XM1Ф	45	23	21	50	6	4,6	170

Key: (1). Ducts due to the state of material with delivery. (2). Trademark of steel. (3). kg/mm². (4). kgf•m/cm³. (5). Hardness according to Brinell HB. (6). diameter of impression in mm. (7). hardness number. (8). it is not less. (9). it is not more. (10). Hot-rolled without annealing. (11). Cold-drawn or cold-rolled after annealing. (12). After annealing.

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Table 12. Assortment of the jointless hot-deformed ducts made of corrosion-resistant steel (GOST 9940-72).

[illegible] мм	$D_н$, мм	(1) Толщина стенки S, мм													
		4,5	5	5,5	6	7	8	9	10	11	12	14	15	16	20
		(2) Масса 1 пог. м в кг													
50	57	5,86	6,45	7,03	7,59	8,69	9,73	—	—	—	—	—	—	—	—
70	76	7,99	8,81	9,62	10,4	12	13,5	15	16,4	—	—	—	—	—	—
80	89	9,44	10,4	11,4	12,4	14,2	16,1	17,9	19,6	21,3	22,9	26	—	—	—
100	108	—	12,8	14	15,2	17,5	19,9	22,1	24,3	26,5	28,6	32,6	34,6	36,5	43,7
100	114	—	13,5	14,8	16,1	18,6	21	23,4	25,8	28,1	30,4	34,7	36,8	38,9	46,6
125	133	—	15,9	17,4	18,9	21,9	24,8	27,7	30,5	33,3	36	41,3	43,9	46,4	56,1
150	159	—	—	—	22,8	26,4	30	33,5	37	40,4	43,8	50,4	53,6	56,8	69
175	194	—	—	—	—	—	—	41,3	45,6	50	54,2	62,5	66,6	70,6	86,3
200	219	—	—	—	—	—	—	—	51,8	56,8	61,6	71,2	75,9	80,6	98,7
225	245	—	—	—	—	—	—	—	—	64,9	70,5	81,6	87,1	92,5	114
250	273	—	—	—	—	—	—	—	—	71,6	77,7	90	96	102	125
300	325	—	—	—	—	—	—	—	—	—	93,2	108	115	123	151

Note. The mass of 1 lin. m of ducts is given for the trademark of steel with a density of 7, 9; the mass of 1 lin. m from the trademarks of steel with another density (see Table 10, chapter I) they calculate according to the formula, given in §3.

Key: (1). Thickness of wall S, mm. (2). Mass of 1 lin. m in kg.

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Table 13. Assortment of the jointless cold and hot-worked ducts made of corrosion-resistant steel (GOST 9941-72).

$D_у$, мм	$D_н$, мм	(1) Толщина стенки S, мм																
		1	1,4	1,5	1,8	2	2,5	3	3,5	4	4,5	5	5,5	6	7	8	9	10
		(2) Масса 1 пог. м*																
10	14	0,32	0,44	0,46	0,54	0,6	0,71	0,82	—	—	—	—	—	—	—	—	—	—
15	18	0,42	0,58	0,61	0,72	0,79	0,96	1,12	1,26	—	—	—	—	—	—	—	—	—
20	25	0,6	0,82	0,87	1,04	1,14	1,4	1,64	1,87	2,08	2,29	—	—	—	—	—	—	—
25	32	0,77	1,06	1,13	1,35	1,49	1,83	2,16	2,48	2,78	3,07	3,35	3,62	—	—	—	—	—
32	38	0,92	1,27	1,36	1,62	1,79	2,2	2,61	3	3,37	3,74	4,09	4,44	4,76	—	—	—	—
40	45	1,09	1,51	1,62	1,93	2,13	2,64	3,13	3,6	4,07	4,52	4,96	5,39	5,81	—	—	—	—
50	57	1,39	1,93	2,07	2,47	2,73	3,38	4,02	4,65	5,26	5,86	6,45	7,03	7,59	8,60	9,73	—	—
70	76	—	—	—	—	—	—	5,44	6,3	7,15	7,99	8,81	9,62	10,4	12	13,5	—	—
80	89	—	—	—	—	—	—	6,4	7,43	8,44	9,44	10,4	11,4	12,4	14,2	16,1	—	—
100	108	—	—	—	—	—	—	—	9,08	10,3	11,6	12,8	14	15,2	17,5	19,9	22,1	24,3

Key: (1). Thickness of wall S, mm. (2). Mass of 1 lin. m [1].

FOOTNOTE [1]. See the note table 12. ENDFOOTNOTE.

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Table 14. Mechanical properties of seamless pipes made of corrosion-resistant steel.

(1) Марка стали (ГОСТ 5632—61*)	(2) Прежнее обозначение марок сталей	(3) Трубы горячедеформированные (ГОСТ 9940—72)		(4) Трубы холодно- и теплодеформированные (ГОСТ 9941—72)	
		$\sigma_в$, (5) кгс/мм²	δ_5, %	$\sigma_в$, (5) кгс/мм²	δ_5, %
		(6) не менее			
1X13	ЭЖ1	40	21	40	22
0X13	ЭИ496	38	22	38	22
X17	ЭЖ17	45	17	45	17
0X17T	ЭИ645	38	17	38	17
X25T	ЭИ439	45	17	47	17
X28	ЭЖ27, ЭИ349	45	17	—	—
0X20H14C2	ЭИ732	52	35	52	35
0X22H5T	ЭП53	60	24	60	20
1X14H18B2БР	ЭИ695Р	56	40	56	35
X17H13M2T	ЭИ448 (X18H12M2T)	54	35	54	35
0X17H16M3T	ЭИ580	52	35	56	35
00X18H10	ЭИ842	45	40	50	45
0X18H10	ЭЯ0 (0X18H9)	52	40	54	37
X18H9	ЭЯ1 (1X18H9)	54	40	56	37
2X18H9	ЭЯ2	58	40	58	35
0X18H10T	ЭИ914	52	40	56	37
X18H10T	ЭЯ1Т (1X18H9T)	54	40	56	35
0X18H12T	—	52	40	56	37
X18H12T	—	54	40	55	35
0X18H12Б	ЭИ402 (X18H11Б)	52	38	54	37
0X23H18	—	50	37	54	35

Key: (1). Trademark of steel. (2). Previous designation of trademarks of steels. (3). Ducts, hot-deformed. (4). Ducts of cold and hot worked. (5). kg/mm². (6). it is not less.

6. Ducts jointless especially thin-walled, cold-drawn and cold-rolled made of corrosion-resistant steel (GOST 10498-63).

Table 15. Assortment of ducts.

(1) Размеры в мм							
$D_н$	S	$D_н$	S	$D_н$	S	$D_н$	S
[illegible]	0,2–0,5	63	0,3–1	80	0,4–1	100	0,5–1
[illegible]–10	0,2–0,7	65	0,3–1	83	0,4–1	110	0,5–1
[illegible]	0,2–1	68	0,3–1	85	0,4–1	120	0,5–1
[illegible]	0,3–1	70	0,3–1	90	0,4–1		
		73	0,3–1	95	0,4–1		
		75	0,3–1				

Key: (1). Sizes/dimensions in mm.

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Ducts supply in the heat-treated state made of steel of the brands/marks 0Kh18N10T, 1Kh18N10T, 1Kh13S2M2, 0Kh16N15M3, 1Kh16N15M3B and 00Kh16N15M3B; they can be supplied with the etched, ground, polished or electropolishing external surface, and also with the etched or electropolishing internal surface (besides ducts from $D_н$ to 5 mm).

The chemical composition of steels see in Table 10, chapter I.

The mechanical properties of ducts in as-received condition must correspond to those indicated in Table 16.

Ducts must be tested by manufacturing plant for intercrystalline corrosion, to flattening, to hydraulic or pneumatic pressure, to mechanical properties according to the standards (see §2, chapter I).

In as-received condition the ducts must hold out the testing hydraulic or pneumatic pressure: with diameter to 20 mm inclusively - not less than 5 kg/cm^2, with the diameter more than 20 mm - not less than 10 kg/cm^2. Test procedure by pneumatic pressure is established by the agreement of sides.

7. Ducts jointless bimetallic (GOST 10192-62*).

Jointless bimetallic ducts prepare cold-rolled and cold-drawn with skin from steel brands 10 or 20 according to GOST 1050-60** and interior layer from copper of brand M3 according to GOST 859-66. Produce ducts in outside diameter 6-370 mm and walls with a thickness of 1.5-10 mm.

Assortment of the frequently used bimetallic ducts is given in Table 17.

Table 16. Mechanical properties of ducts made of corrosion-resistant steels (GOST 10498-63).

(1) Марка стали	(2) Прежнее обозначение марки стали	$\sigma_в$, кгс/мм² (3)	δ_5, %
		(4) не менее	
0X18H10T	ЭИ914	54	40
1X18H10T	ЭЯ1Т	56	40
1X13C2M2	ЭИ852	55	20
0X16H15M3	ЭИ844	56	38
1X16H15M3Б	ЭИ847	55	35
00X16H15M3Б	ЭИ844Б	52	38

Key: (1). Trademark of steel. (2). Previous designation of trademark of steel. (3). kg/mm². (4). it is not less.

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8. Ducts steel electric welding.

Assortment and mass of electric welding ducts are given in Table 8.

Depending on purpose and guaranteed characteristics [illegible] ducts supply by the following groups:

1. according to GOST 10704-63*
~~[illegible]~~ and 10705-63* with outside diameter from 8 to 530 mm and wall thickness to 10 mm inclusively.

Table 17. Assortment of the jointless bimetallic cold-rolled and cold-drawn ducts (GOST 10192-62).

$D_н$, мм	(1) Толщина стенки S, мм							
	1,5	2	2,5	3	3,5	4	4,5	5
	(2) Масса 1 пог. м в кг							
6	0,17	—	—	—	—	—	—	—
10	—	0,41	—	—	—	—	—	—
14	0,49	0,62	0,74	—	—	—	—	—
18	0,65	0,82	1	1,16	—	1,42	—	—
22	—	1,03	—	1,47	1,66	1,82	1,98	—
25	—	1,18	1,46	1,7	—	2,13	—	2,55
28	1,04	1,34	—	—	2,19	2,44	—	—
32	1,2	1,54	—	2,26	2,56	2,82	—	—
38	1,43	1,86	2,3	—	3,1	—	—	—
42	—	2,07	—	—	—	—	—	4,68
45	1,71	2,22	2,76	—	—	—	—	5,06
50	—	2,48	—	—	—	—	—	5,7
55	—	—	3,41	—	—	—	—	—

Notes: 1. The wall thickness of duct is shown with cladding layer.

2. Mass of 1 lin. m of duct is determined according to formula

$$G_{бм}=\left[1+\left(\frac{\gamma_м}{\gamma_с}-1\right)n\right]G_с, \qquad (2)$$

where $\gamma_м$ - copper density; $\gamma_м=8.9$; $\gamma_с$ - steel density; $\gamma_с=7.85$; G_c - mass of 1 lin. m of duct made of steel, which is of the same size with bimetallic duct (see Table 8); n - volumetric coefficient of plating.

$$n=\frac{d_1^2-d_0^2}{D_0^2-d_0^2}. \qquad (3)$$

where d_1 - outside diameter of copper layer in mm; d_0 - bore of bimetallic duct in mm; D_0 - outside diameter of bimetallic duct in mm;

$$d_1=d_0+2\delta.$$

Here δ - nominal (calculation) thickness of copper layer.

Technical requirements for ducts must correspond to the technical specifications, confirmed in routine.

Key: (1). Thickness of wall S, mm. (2). Mass of 1 lin. m in kg.

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A - by the chemical composition made of killed steel of the brands/marks VSt.3sp and VSt.4sp, according to GOST 380-71, and also made of steel of brands 08; 10; 15; 20 according to GOST 1050-60* (see Table 2 and 4, chapter I) and mechanical properties according to Table 18 and 19.

B - by the chemical composition without the guarantee of the mechanical properties of ducts made of the steady, semikilled and rimmed steel of brands St.2, St.3 and St.4 of group B of GOST 380-71, and also made of steel of brands 08, 10, 15 and 20 according to GOST 1050-60* (see Table 2 and 4, chapter I);

C - according to mechanical properties according to Table 18 and

19 without the guarantee of the chemical composition of brands St.2, St.3 and St.4 according to GOST 380-71;

D - without the standardization of the chemical composition and mechanical properties, but with hydraulic test.

All ducts must age testing hydraulic pressure: with diameter to 102 mm - 60 kg/cm² and with the diameter of 102 mm and more - 30 kg/cm².

Table 18. Mechanical properties of the electric welding ducts, supplied by thermally treated (GOST 10704-63*).

(1) Марка стали	$\sigma_в$, кгс/мм² (2)	δ_5, %
	(3) не менее	
08	32	25
10; Ст.2	34	24
15; Ст.3; ВСт.3	38	22
20; Ст.4; ВСт.4	42	21

Key: (1). Trademark of steel. (2). kg/mm². (3). it is not less.

Table 19. Mechanical properties of the electric welding ducts, supplied without heat treatment (GOST 10704-63).

(2) Марка стали	(1) Трубы диаметром					
	(3) 63 мм и более		(4) 20—60 мм со стенкой толщиной 0,06 $D_н$ и менее		до 20 мм, (5) а также 20—60 мм со стенкой толщиной более 0,06 $D_н$	
	(6) $\sigma_в$, кгс/мм²	δ_5, %	(6) $\sigma_в$, кгс/мм²	δ_5, %	(6) $\sigma_в$, кгс/мм²	δ_5, %
	(7) не менее					
08; 10 (8) и Ст.2	32	23	34	15	38	6
15; Ст.3; ВСт.3	36	21	38	13	45	5
20; Ст.4; ВСт.4	38	20	40	10	50	4

Key: (1). Ducts by diameter. (2). Trademark of steel. (3). 63 mm and more. (4). 20-60 mm with wall with a thickness of 0.66 $D_н$ and less. (5). to 20 mm, and also 20-60 mm with wall by thickness more than 0.06. (6). kg/mm². (7). it is not less. (8). and.

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On the demand of consumer the ducts of groups A and B must be tested by large hydraulic pressure, but it is not more than pressure P, determined according to formula GOST 3845-65, with allowable stress R, equal to 40o/o of tensile figure for this brand/mark of steel;

2) according to GOST 10704-63* and 10706-63 straight-seamed in diameter from 426 to 1620 mm;

A - by the chemical composition and the mechanical properties for sheet steel according to GOST 500-58** and 8597-57 of the trademarks of steel, indicated in order, with the simultaneous by a hydraulic pressure test, calculated according to formula GOST 3845-65 (see §2. chapter I) with allowable stress R=0.9 of yield point;

B - by the chemical composition of the trademarks of steels, indicated in order, with the testing by hydraulic pressure 25 kg/cm². Ducts by sizes/dimensions 920x7; 1020x8; 1120x8-9; 1220x9-10; 1320x9-11 and 1420x10-11 test/experience with pressure 20 kg/cm²;

C - according to the mechanical properties of the trademarks of steels, indicated in order without the guarantee of the chemical

composition, with the testing by hydraulic pressure according to formula GOST 3845-65 with allowable stress R=0.5 of tensile figure;

D - without the guarantee of the chemical composition and mechanical properties, but with the testing by hydraulic pressure as for the ducts of group B;

3) according to GOST 10707-63, 10705-63* and 8733-66 cold-drawn and cold-rolled in diameter from 5 to 76 mm.

Material for ducts must correspond to GOST 10705-63, and remaining technical requirements - GOST 8733-66;

4) according to GOST 8696-62 with spiral weld in diameter from 400 to 1200 mm:

A - by the chemical composition and mechanical properties made of steel of brands/marks VSt.2sp and VSt.3 according to GOST 380-71 (see Table 1 and 2, chapter I) and brands 10G2S1 according to GOST 5058-65* (see Table 5 and 6, chapter I), and also with the testing by hydraulic pressure, calculated according to formula GOST 3845-65, where R=0.85 yield point;

B - by the chemical composition made of steel of the

brands/marks St.2kp, St.3 and St.3kp according to GOST 380-71 (Table 2, chapter I) and with the testing by hydraulic pressure 25 kg/cm²;

C - according to mechanical properties made of steel of brands/marks St.2 and St.3 according to group A of GOST 380-71 and of brand 10G2S1 and GOST 5058-65* (see Table 1 and 5, chapter I) and with the testing by hydraulic pressure as for the ducts of group A;

D - without the standardization of the chemical composition and mechanical properties, but with the testing by hydraulic pressure 25 kg/cm².

Depending on designations/purposes and technical requirements, set forth for electric welding ducts, the manufacturing plant conducts the tests: for flattening, distribution, knee, flanging, stretching, impact viscosity/ductility/toughness and for hydraulic pressure according to the standards (see §2, chapter I).

9. Ducts electric welding made of corrosion-resistant steel (GOST 11068-64).

Ducts are delivered heat-treated from the trademarks of steels with mechanical ~~[illegible]~~ properties, indicated in Table 20.

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Ducts produce with outside diameter 8; 9; 10; 11; 12; 14; 15; 16; 18; 20; 22; 25; 28; 30; 32; 34; 36; 38; 40; 42; 45; 48; 50; 53; 55; 57; 60; 63; 65; 70; 76; 89; 102 mm; with walls with a thickness of 1; 1.2; 1.4; 1.8; 2; 2.2; 2.5; 2.8; 3; 3.2; 3.5; 4 mm.

The chemical composition of the metal of ducts is given in Table 10, chapter I.

The mass of ducts made of steel with a density of 7.9 is given in Table 13.

Mass 1 lin. m of ducts in kg. calculate according to the formula, given in §3.

The supplied ducts on manufacturing plant test to stretching, flattening, distribution, flanging, knee, intercrystalline corrosion and they subject to hydraulic pressure according to the standards (see §2, chapter I).

Table 20. Mechanical properties of ducts.

(1) Марка стали	(2) После термической обработки		(3) Без термической обработки		(4) Плотность
	(5) $\sigma_в$, кгс/мм²	δ_5, %	$\sigma_в$, (5) кгс/мм²	δ_5, %	
	(6) не менее				
00Х18Н10Т	50	40	60	25	7,9
0Х18Н10Т	54	37	60	25	7,9
Х18Н10Т	56	35	60	25	7,9
0Х18Н12Т	54	37	60	25	7,95
Х18Н12Т	56	35	60	25	7,95
Х17Н13М2Т	(7) По соглашению сторон				8
Х17Н13М3Т					8
0Х22Н5Т					7,6
1Х21Н5Т					7,6
0Х23Н28М2Т					7,95
0Х23Н28М3Д3Т					7,95

Key: (1). Trademark of steel. (2). After heat treatment. (3). Without heat treatment. (4). Density. (5). kg/mm². (6). it is not less. (7). By agreement of sides.

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Each of the supplied ducts must hold out testing for hydraulic pressure 60 kg/cm², but more calculated according to the formula

$$P = \frac{200 S_н R}{D_в} \text{ кгс/см}^2 \, (1), \qquad (4)$$

Key: (1). kg/cm^2.

where $S_м$ - minimum wall thickness of duct in mm; R - the allowable stress in kg/mm^2, equal to 40o/o of tensile figure for steel of this brand/mark; $D_в$ - tube bore in mm.

10. Ducts steel water-gas conducting.

Water-gas conducting ducts are prepared from steel of brands/marks according to GOST 380-71 by furnace butt welding or by electric welding.

Depending on the designation/purpose the ducts are tested for bending, ~~[illegible]~~ stretching and hydraulic pressure according to standards (see § 2, Chap. I). ~~[illegible]~~

Light and ordinary ~~[illegible]~~ ducts must withstand ~~are~~ hydraulic pressure of ~~[illegible]~~ kg/cm^2, and intensified - 32 kg/cm^2.

Table 21. Assortment of steel water-gas conducting ducts (GOST 3262-62).

D_y, мм	$D_н$ мм	(1) Трубы					
		(2) легкие		(3) обыкновенные		(4) усиленные	
		S, мм	(5) масса 1 пог. м (без муфт) в кг	S, мм	(5) масса 1 пог. м (без муфт) в кг	S, мм	(5) масса 1 пог. м (без муфт) в кг
6	10,2	1,8	0,37	2	0,4	2,5	0,47
8	13,5	2	0,57	2,2	0,61	2,8	0,74
10	17	2	0,74	2,2	0,8	2,8	0,98
15	21,3	2,5	1,16	2,8	1,28	3,2	1,43
20	26,8	2,5	1,5	2,8	1,66	3,2	1,85
25	33,5	2,8	2,12	3,2	2,39	4	2,91
32	42,3	2,8	2,73	3,2	3,09	4	3,78
40	48	3	3,33	3,5	3,84	4	4,31
50	60	3	4,22	3,5	4,88	4,5	6,16
70	75,5	3,2	5,71	4	7,05	4,5	7,88
80	88,5	3,5	7,34	4	8,34	4,5	9,32
90	101,3	3,5	8,44	4	9,6	4,5	10,74
100	114	4	10,85	4,5	12,15	5	13,44
125	140	4	13,42	4,5	15,04	5,5	18,24
150	(165)	4	15,88	4,5	17,81	5,5	21,63

Key: (1). Ducts. (2). lungs. (3). usual. (4). intensified. (5). mass of 1 lin. m (without clutches) in kg.

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Chapter III.

WELDED PARTS OF STEEL CONDUITS.

§1. General information.

The welded parts of steel conduits/manifolds using the method of their execution subdivide into the jointless, prepared with method stampings, drawings or flexure from a rough or special blank, and welded, prepared of their separate to be welded between themselves cuts of ducts or sheet steel.

Jointless parts as a result of the small labor consumption of manufacture and possibility from the centralized mass production at the specialized plants received widest acceptance and they are the basic form of the welded parts, used by assembling organizations.

Basic types and sizes/dimensions of the welded jointless and fabricated members of steel conduits/manifolds are standardized

(Table 1). The parts, not provided for by standards, can be prepared on the working drawings of planning organizations.

Table 1. Enumeration of the standardized welded parts of conduits/manifolds made of carbon steel.

(1) Наименование	(2) $P_у$, кгс/см², не более	$D_у$, мм	(3) Номер нормали	(4) Номер таблицы
(5) Отводы:				
(5a) а) крутоизогнутые под углом 90, 60 и 45° . .	100	40—500	МСН 120-69 / ММСС СССР	2
(5b) б) гнутые под углом 15, 30, 45, 60 и 90° . . .	100	20—400	МН 2912-62	3
(5c) в) сварные под углом 30, 45, 60 и 90°	64	150—1600	МН 2877-62 МН 2880-62	4
(6) Полусекторы с углом скоса 15 и 22°30′	64	150—1600	МН 2881-62	5
(7) Секторы с углом скоса 30°	64	150—1600	МН 2882-62	5
(8) Тройники равнопроходные:				
(8a) а) бесшовные	100	40—350	МСН 120-69 / ММСС СССР	6
(8b) б) сварные	100	40—1600	МН 2883-62	7
(9) Тройники переходные:				
(9a) а) бесшовные	100	50—350*	МСН 120-69 / ММСС СССР	8
(9b) б) сварные	100	40—1600*	МН 2887-62	9
(10) Переходы концентрические и эксцентрические:				
(8a) а) бесшовные	100	50—[illegible]*	МСН 120-69 / ММСС СССР	10
(9b) б) сварные	[illegible]	150—500*	МН [illegible] МН [illegible]	11
(11) Заглушки отбортованные .	100	40—500	МСН 120-69 / ММСС СССР	12
(12) Днища:				
(12a) плоские	25	40—600	МН 2890-62	13
(12b) плоские ребристые . . .	25	400—600	МН 2891-62	14

Notes: 1. Table shows the maximum conventional pressure at which can be used welded parts. The allowable conventional pressure is determined by the type of duct, wall thickness and the brand/mark of steel from which the part was manufactured.

2. Internal diameters, noted, * are given on greater diameter of

T-connection
reducing ~~tee~~ or transition.

3. Data about parts by diameter less than 40 and more than 600 mm, and also about offtakes at angle of 15 and 30°, that have limited application, in table they are not brought.

Key: (1). Designation. (2). kg/cm², are not more. (3). Number of standard. (4). Number of table. (5). Offtakes. (5a). sharply bent at angle of 90, 60 and 45°. (5b). bent at angle of 15, 30, 45, 60 and by 90°. (5c). welded at angle of 30, 45, 60 and 90°. (6). Half-sectors with angle of rake 15 and 22°30'. (7). Sectors with angle of rake of 30°. (8). T-connections equal-flow: (8a). jointless. (8b). welded. (9). T-connections (transitional. (10). Transitions (concentric and eccentric). (11). Silencers/plugs, flanged. (12). Bottoms. (12a). flat/plane. (12b). flat/plane finned.

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In the system of the Ministry of the Installation and Special construction work of the USSR the centralized manufacture of jointless parts is accomplished/realized in accordance with the "nomenclature of the parts of conduits/manifolds made of carbon steel on P_y to 100 kg/cm², produced by the enterprises of Minmontazhspetsstroy of the USSR, MSN 120-69/MMSS USSR".

Fabricated members prepare on standards machine-buildings.

The limits of the use/application of welded parts depend on the type of ducts and trademark of steel from which they are manufactured.

Offtakes are used for the rotation of the axis/axle of conduit/manifold to preset angle. By construction/design they are subdivided into sharply bent ones, bent and welded ones.

Sizes/dimensions and mass of the standardize jointless sharp-bend offtakes made of carbon steel are given in Table 2.

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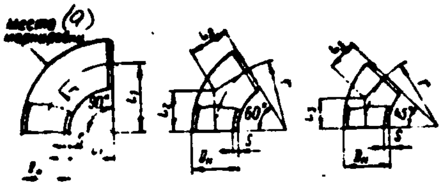
Table 2. Offtakes jointless sharply bent on P_y from 1 to 100 kg/cm²

(MSN 120-69/MMSS USSR). (a)



(1) Размеры в мм						(2) Масса в кг отводов под углом φ			(3) P_y, кгс/см², не более
D_y	$D_н$	$r = L_1$	L_1	L_2	S	90°	60°	45°	
•	•		[illegible]	[illegible]	[illegible] 4	0,[illegible] 0,[illegible]	0,17 0,[illegible]	0,12 0,19	100 •
50	57	75	43	30	3,5 6	0,54 0,89	0,36 0,59	0,27 0,44	100 •
65	76	105	61	43	3,5 6 7	1,03 1,73 1,96	0,69 1,15 1,28	0,51 0,86 0,96	64 100 •
80	89	120	69	50	3,5 4,5 6 8	1,39 1,77 2,32 3,01	0,93 1,18 1,55 2	0,69 0,88 1,16 1,5	64 100 • •
100	108	150	87	62	4 5 7 9	2,42 2,99 4,11 5,17	1,61 1,99 2,74 3,45	1,21 1,49 2,05 2,58	64 100 • •
	114				6	3,76	2,51	1,88	•
125	133	190	110	79	4 5 7 10	3,79 4,71 6,49 9,1	2,53 3,16 4,33 6,06	1,89 2,35 3,24 4,55	64 • 100 •
150	159	225	130	93	4,5 6 8 11	6,06 8 10,5 14,1	4,04 5,33 7 9,39	3,03 4 5,25 7,04	40 60 100 •
	168				6 8	8,47 11,2	5,65 7,44	4,23 5,58	• •
200	219	300	173	124	6 7 9 11 14	14,8 17,2 22 26,6 33,4	10 11,5 14,6 17,7 22,2	7,4 8,62 11 13,3 16,7	25 64 • 100 •
250	273	375	217	155	7 9 12 16	27 34,5 45,6 60	18 23 30,4 40	13,5 17,3 22,8 30	25 64 • 100
300	325	450	260	186	8 9 10 14 16	44,2 49,5 54,9 75,9 86,5	29,8 33,2 36,6 50,6 57,7	22,1 24,8 27,5 [illegible] 43,3	25 40 64 • 100

(1). Размеры в мм						(2). Масса в кг отводов под углом φ			(3). P_y, кгс/см², не более
D_y	$D_н$	$r=L_1$	L_2	L_3	S	90°	60°	45°	
350	377	525	303	217	10 12 16	74,6 89,1 117,5	49,8 59,4 78,3	37,3 44,7 58,7	40 64 *
400	426	600	346	248	9 11 16	87,2 106 153	58,1 70,6 102	43,6 53,1 76,2	40 * 64
500	[illegible]	[illegible]	[illegible]	207	10 14	110 140	67,1 93,3	55,2 70	25 40

Notes: 1. Offtakes in diameter 114 and 168 mm prepare on separate orders.

2. Pressures conventional P_y are shown for nonagressive and slightly agressive media. Sign * noted the offtakes, used for moderately aggressive media: the allowable conventional pressure for them is determined by calculation.

Key: (a). Place of marking. (1). Sizes/dimensions in mm. (2). Mass in kg. of offtakes at angle φ. (3). kg/cm², are not more.

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The bent offtakes are prepared from jointless or electric welding ducts by flexure on tube-bending machines in cold or hot state. They are characterized by a comparatively large bending radius

(more than 3 $D_н$), by the presence at the ends of the long straight/direct sections and because of this by large mass.

Sizes/dimensions and mass of the bent offtakes made of carbon steel are given in Table 3.

Welded offtakes are prepared from the separate elements/cells (sectors and half-sectors), cut from ducts. They have small straight/direct sections (in the limits of the minimally permissible distance between two welds) and usually a small bending radius (1.1.5 $D_у$). Welded offtakes are used when the manufacture of offtakes with the prescribed/assigned radius by other methods is hindered/hampered.

Sizes/dimensions and mass of the standardize welded offtakes made of carbon steel are given in Table 4, but half-sectors and sectors from which they are prepared, - in Table 5.

The welded offtakes, manufactured from seamless pipes according to GOST 8732-70 and 8734-58** are allowed/assumed and to installation in conduits/manifolds on $P_у$ to 64 kg/cm², and manufactured from electric welding ducts according to GOST 10704-63* - on $P_у$ to 25 kg/cm².

T-connections are used for the device of branches from ducts.

They are subdivided into equal-flow (without a change in the diameter branch) and transitional (with the reduced diameter of branch).

Jointless T-connections are prepared from seamless pipes by hot stamping in multipass dies/stamps on crank or hydraulic ~~[illegible]~~ presses.

Sizes/dimensions and mass of jointless equal-flow and transitional T-joints made of the carbon steel are given in Tables 6 and 8.

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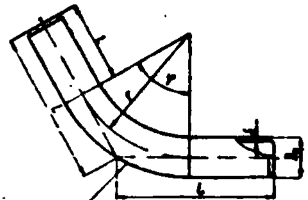
Table 3. Offtakes bent from ducts on P_y to 100 kg/cm² (НН 2912-62).



(a) [illegible]

(1) Размеры в мм											(2) Масса в кг отводов под углом φ		
(3) общие					(4) отводов под углом φ								
					45°		60°		90°				
D_y	$D_н$	r	l	S	L (5)	развернутая длина	L (6)	развернутая длина	L (6)	развернутая длина	45°	60°	90°
40	45	140	100	2 2,5 4	158	310	181	347	240	420	0,66 0,81 1,25	0,74 0,93 1,4	0,89 1,1 1,7
50	57	180	110	3 3,5 5	185	361	214	408	290	503	1,44 1,67 2,31	1,63 1,88 2,62	2,01 2,32 3,22
65	76	225	150	3 3,5 4,5 6	243	477	280	635	375	653	2,57 2,98 3,78 4,93	2,89 3,35 4,25 5,54	3,52 4,08 5,18 6,75
80	89	280	180	3 3,5 4,5 6	293	580	342	653	460	800	3,69 4,28 5,44 7,12	4,15 4,82 6,13 8,02	5,09 5,9 7,5 9,82
100	108	360	220	3 4 5 7	369	723	428	817	580	1005	5,62 7,42 9,18 12,6	6,35 8,38 10,4 14,3	7,8 10,3 12,8 17,5
125	133	400	270	4 7 9	436	864	501	959	670	1168	10,9 18,6 23,5	12,2 20,9 26,4	[illegible]
150	159	500	320	4,5	527	1033	600	1164	820	1425	17,7	[illegible]	[illegible]

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Размеры в мм											Масса в кг отводов под углом φ		
общие					отводов под углом φ								
					45°		60°		90°				
D_y	$D_н$	r	l	S	L	развернутая длина	L	развернутая длина	L	развернутая длина	45°	60°	90°
150	159	500	320	6 8 10	527	1033	609	1164	620	1425	23,4 30,8 38	26,4 34,7 42,8	32,3 42,5 52,4
200	219	630	450	6 7 10 12	711	1395	814	1560	1060	1890	44,0 50,5 71,9 85,5	49,2 56,3 80,4 95,6	59,6 68,2 97,4 116
250	273	800	560	7 8 12 14	881	1728	1012	1938	1350	2357	79,4 90,3 133 156	89 101 150 173	108 123 182 211
300	325	1000	650	7 8 10 14 16	1032	2085	1227	2347	1650	2871	114 130 162 224 254	129 147 182 252 286	159 180 223 308 350
350	377	1120	760	9 12 14 18	1224	2400	1407	1693	1880	3279	196 259 301 382	220 291 338 429	268 354 411 522
400	426	1250	850	7 10 12 14	1368	2682	1572	3009	2100	3664	194 275 329 381	218 309 369 428	265 376 449 521

Notes: 1. Offtakes are prepared from the jointless ducts according to GOST 8712-70 and 8731-58** and electric welding according to GOST 10704-63*.

2. Diameters and wall thicknesses of offtakes are given in accordance with ~~[illegible]~~ "inventory and electric welding ducts of Minmontazhspetsstroy USSR, ~~[illegible]~~ MSN 186-68."

Key: (a). Place of marking. (1). Sizes/dimensions in mm. (2). Mass in kg. of offtakes at angle ϕ. (3). general/common/total. (4). offtakes at angle ϕ. (5). expanded/scanned length.

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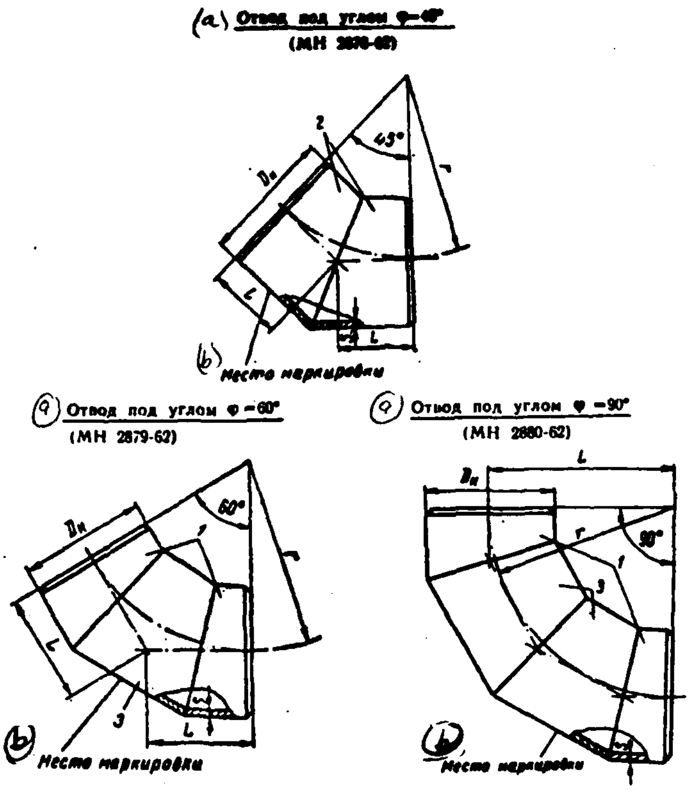
Table 4. Offtakes are welded on P_y to 64 kg/cm².



1 - half-sector with the angle of rake of 15°; 2 - half-sector with the angle of rake 22°30'; 3 - sector with the angle of rake of 30°.

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(1) Размеры в мм				(2) P_y, кгс/см² не более	(3) Отводы под углом φ					
					45°		60°		90°	
D_y	$D_н$	S	r		L, мм	(4) масса в кг	L, мм	(4) масса в кг	L, мм	(4) масса в кг
150	159	4,5 6 8 10	225	40 64 • •	93	3,3 4,3 5,74 7,17	130	4,29 5,67 7,56 9,45	225	[illegible] [illegible] 11,1 14,1
200	219	6 7 10	300	25 64 •	124	7,92 9,35 13,3	173	10,4 12,2 17,3	300	15,6 18,4 26
250	273	7 8 10	375	25 64 •	155	14,6 16,6 20,6	216	18,9 21,6 27	375	27,5 31,4 39,3
300	325	8 10 14	450	40 64 •	186	21,4 29,6 41	260	30,9 38,6 53,7	450	41,8 56 80,4
350	377	9 12 14	525	40 64 •	217	36,4 48,1 56,1	303	47,5 62,6 73,1	525	71,2 94 110
400	426	7 10 12 14	600	25 40 64 •	248	36,4 51,8 62,2 72,6	346	47,5 67,6 81,1 94,6	600	71,2 101 133 141
500	530	7 8	500	16 25	207	38 43,4	289	49,4 56,5	500	74 84,8
		7 8	750	16 25	310	56,4 64,5	435	73,6 84,1	750	110 126
600	630	7 10	600	16 25	249	54,1 77,1	346	70,3 100	600	106 151
		7 10	900	16 25	372	80,7 115	520	105 180	900	157 226

Notes: 1. Diameters and the wall thicknesses of offtakes are given in accordance with the "assortment of the jointless and electric welding ducts of Minmontazhspetsstroy USSR, MSN 186-68/MMSS USSR".

2. Sizes/dimensions of half-sectors and sectors are given in Table 5.

3. Conventional designations are indicated for nonagressive and slightly agressive media. Sign notes branches used for moderately aggressive media; the allowable conventional pressure for them is determined by calculation.

Key: (a). Offtake at angle. (b). Place of marking. (1). Sizes/dimensions in mm. (2). kg/cm² are not more. (3). Offtakes at angle. (4). mass in kg.

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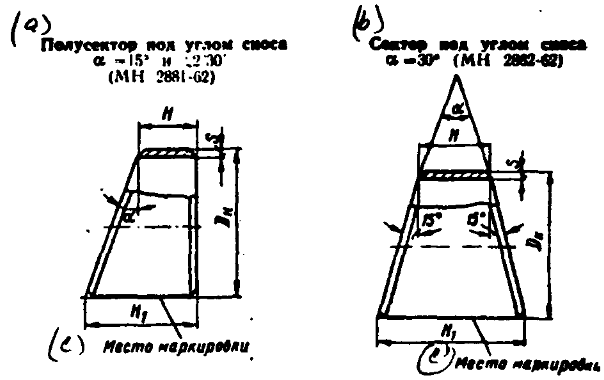
Table 5. Half-sectors and sectors for welded offtakes.



(1) Размеры в мм								
D_y	$D_н$	r	(2) полусектор под углом α				(3) сектор под углом α=30°	
			15°		22° 30′			
			H	H_1	H	H_1	H	H_1
150	159	225	39	81	60	126	78	162
200	219	300	51	110	79	170	102	220
250	273	375	64	137	99	212	128	274
300	325	450	77	164	119	254	154	328
350	377	525	90	191	139	295	180	382
400	426	600	104	218	160	337	208	436
500	530	750	130	272	201	420	260	544
500	530	500	63	206	97	317	126	410
600	630	900	157	326	242	503	314	652
600	630	600	76	245	118	379	152	[illegible]

Note. Half-sectors and sectors prepare from the ducts of jointless ones according to GOST 8732-70 and 8734-58** and electric welding according to GOST 10704-63*.

Key: (a). Half-sector at the angle of bevel of $\alpha=15°$ and 22°30'. (b). Sector at angle of bevel. (c). Place of marking. (1). Sizes/dimensions in mm. (2). half-sector at angle. (3). sector at angle.

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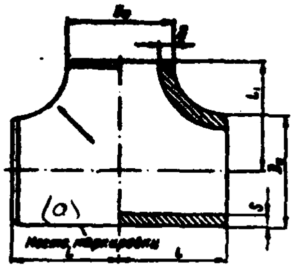
§3. T-connections made of carbon steel jointless and welded.

1. Equal-flow T-connections.

Table 6. T-connections equal-flow, jointless on P_y to 100 kg/cm²
(MSN 120-69/MMSS USSR).



(1) Размеры в мм						(3) P_y, кгс/см², не более	(4) Масса в кг
D_y	$D_н$	L	L_1	S	(2) $D_н \times S$ (присоединяемых труб)		
40	45	40	40	2,5 4	45×2,5 45×2,5	40 64	0,24 0,27
50	57	50	50	3,5 6	57×3,5 57×3,5	40 100	0,54 0,89
65	76	70	70	3,5 7	76×3,5 76×4,5	25 100	1,05 2,03
80	89	75	75	3,5 6	89×3,5 89×4,5	16 64	1,26 2,11
100	108	90	90	5 7	108×4 108×4	25 64	2,53 3,6
125	133	110	110	4 7	133×4 133×4	16 40	3,15 5,43
150	159	130	130	4,5 6 8	159×4,5 159×4,5 159×6	16 25 40	5 6,6 8,75
200	219	160	140	7 10	219×6 219×7	25 40	15,6 19,3
250	273	190	173	8 12	273×7 273×8	16 40	20,2 31,2
300 350	325 377	240 260	220 240	10 12	325×8 377×9	25 16	40,3 54,8

Note. Pressures conventional P_y are shown for nonagressive and moderately-aggressive media.

Key: (a). Place of marking. (1). Sizes/dimensions in mm. (2). added ducts. (3). kg/cm², are not more. (4). Mass in kg.

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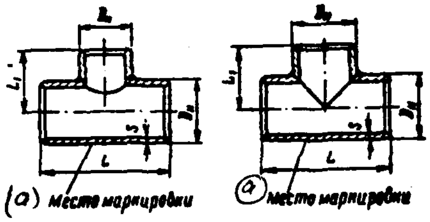
Table 7. T-connections equal-flow, welded on P_y to 100 kg/cm² (MN 2886-62).



(1) Размеры в мм						(2) Масса в кг	(3) P_y, кгс/см², не более
D_y	$D_н$	L	L_1	S	$D_н \times S$		
150	159	450	220	8 11 16	159×6 159×8 159×10	17,8 24 34	64 100 100*
200	219	500	255	10 14 20	219×7 219×10 219×12	33,7 46,4 64,7	64 100 100*
250	273	600	305	11 16 20	273×8 273×12 273×14	55,1 79 97,5	64 64* 100
300	325	700	330	14 20 22 28	325×10 325×14 325×16 325×16	92 129 145 176	64 64* 100 100*
350	377	800	375	16 20 25 30	377×12 377×14 377×18 377×18	138 176 218 260	64 64* 100 100*
400	426	900	405	12 16 20 25	426×10 426×12 426×14 426×11	135 179 222 275	40 40* 64 64*
500	530	1100	490	9 14	530×7 530×8	154 [illegible]	16 [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	10 14	630×7 630×10	237 324	16 25

Notes: 1. T-connections are prepared from the ducts of jointless ones according to GOST 8732-70 and 8734-58**, also, with D_y 500 and 600 mm - from the ducts of electric welding ones according to GOST 10704-63*.

2. Pressures conventional P_y are shown for nonagressive and slightly agressive media. T-connections with P_y, that noted, use for moderately aggressive media.

Key: (a). Place of marking. (1). Sizes/dimensions in mm. (2). Mass in kg. (3). kg/cm², are not more.

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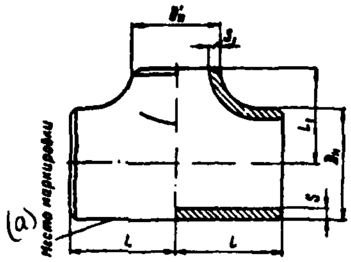
2. T-connections are transitional.

Table 8. T-connections jointless transitional stamped/die-forged on P_y to 100 kg/cm² (MSN 120-69/MMSS USSR).



(1) Размеры в мм							(2) P_y, кгс/см², не более	(3) Масса в кг
$D_y \times D_y'$	$D_н$	$D_н'$	L	L_1	S	S_1		
50×40	57	45	50	45	3,5 6	2,5 4	40 64	0,5 0,81
65×40	76	45	70	60	3,5 7	2,5 4	25 64	0,9 1,7
65×50	76	57	70	65	3,5 7	3,5 6	25 100	0,98 1,79
80×50	89	57	75	66	3,5 6	3,5 6	16 64	1,15 1,91

$D_y \times D_y'$	$D_н$	$D_н'$	L	L_1	S	S_1	P_y, кгс/см², не более	Масса в кг
	(1) Размеры в мм						(2)	(3)
80×65	89	76	75	70	3,5 6	3,5 6	16 64	1,23 2,06
100×65	108	76	90	80	5 7	4 6	25 64	2,36 3,27
100×80	108	89		85	4 7	3,5 7	25 64	2,01 3,42
125×80	133	89	110	95	4 7	3,5 7	16 40	2,89 5,1
125×100	133	108		100	4 7	4 7	16 40	2,97 5,09
150×100	159	108	130	115	4,5 6 8	4 5 7	16 25 40	4,61 6,07 7,79
150×125	159	133		120	4,5 8	4 7	16 40	4,7 8,01
200×125	219	133	160	140	7	4	16	24,5
				150	10	7	40	24,5
200×150	219	159			7	4,5	16	23,6
				140	10	8	40	23,6
250×150	273	159	190	180	8	4,5	16	40,6
				170	12	8	40	40,6
250×200	273	219		180	8	7	16	42,6
				170	12	10	40	42,6
300×200	325	219	240	205	10	7	25	62,8
300×250	325	273		210	10	8	25	61,7
350×300	377	325		225	12	10	16	[illegible]

Note. The sizes/dimensions of the added ducts see in Table 6.

Key: (a). Place of marking. (1). Sizes/dimensions in mm. (2). kg/cm² are not more. (3). Mass in kg.

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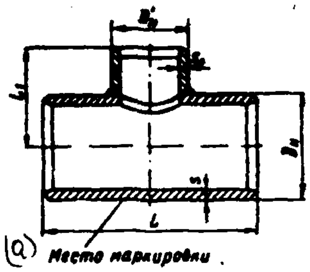
Welded T-connections are prepared from jointless or electric welding ducts via the fitting of connecting pipe into duct with the subsequent seal of joint. As a result of weakening the ducts of T-connection in the place of the contiguity of connecting pipe (due to the cutout of static opening) for obtaining the uniformly strong conduit/manifold welded T-connections prepare with the greater wall thickness, than in the added duct.

The T-connections, manufactured from seamless pipes according to GOST 8732-70 and 8734-58** from D_y to 350 mm, is allowed/assumed to use in conduits/manifolds on P_y to 100 kg/cm², D_y=400 мм - to 64 kg/cm², and those manufactured from electric welding ducts according to GOST 10704-63* - to 25 kg/cm².

Sizes/dimensions and mass of welded ones it is branch made of carbon steel they are given in Tables 7 and 9.

Table 9. Welded transition T-pieces for P_y to 100 kg/cm^2 (MN 2887-62)



(1) Размеры в мм								(3) P_y, кгс/см², не более	(4) Масса в кг
$D_y \times D'_y$	$D_н$	$D'_н$	L	L_1	S	S_1	(2) $D_н \times S - D_н \times S_1$ (присоединяемых труб)		
150×100	159	108	450	210	8 11 16	7 7 9	159×6—108×4 159×8—108×5 159×10—108×7	15,4 20 27,7	64 100 100*
150×125	159	133	450	220	8 11 16	7 7 10	159×6—133×4 159×8—133×7 159×10—133×9	16,1 20,5 29	64 100 100*
200×125	219	133	500	250	10 14 20	7 7 10	219×7—133×4 219×10—133×7 219×12—133×9	28,2 37,5 52,2	64 100 100*
[illegible]	219	159	500	250	10 14 20	7 8 11	219×7—159×6 219×10—159×8 219×12—159×10	28,6 38,6 53,2	64 100 100*
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11 16 [illegible]	7 8 11	273×8—159×6 273×12—159×8 273×14—159×10	45,3 61,5 77	64 64* 100
250×200	273	219	600	280	11 16 20	9 10 14	273×8—219×7 273×12—219×10 273×14—219×12	47,8 65,6 82,4	64 64* 100
300×200	325	219	700	330	14 20 22	9 10 14	325×10—219×7 325×14—219×10 325×16—219×12	80,5 113 123	64 64* 100
300×250	325	273	700	330	14 20 22	9 11 16	325×10—273×8 325×14—273×12 325×16—273×14	81,3 114 127	64 64* 100
350×250	377	273	800	360	16 20 25	9 11 16	377×12—273×8 377×14—273×12 377×18—273×14	119 147 183	64 64* 100
350×300	377	325	800	360	16 20 25	10 14 16	377×12—326×10 377×14—325×14 377×18—326×16	121 153 186	64 64* 100
400×300	426	325	900	380	16 20	9 14	426×10—325×8 426×14—325×10	40 64	150 191
400×350	426	377	900	400	16 20	9 16	426×10—377×9 426×14—377×12	40 64	[illegible] [illegible]

Key: (a). Place of marking. (1). Sizes/dimensions in mm. (2). added ducts. (3). kg/cm², are not more. (4). Mass in kg.

FOOTNOTE [1]. See notes to Table 7. ENDFOOTNOTE.

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Transitions serve for changing the diameter of conduit/manifold. By construction/design them they subdivide into concentric ones and eccentric ones.

Sizes/dimensions and mass of the standardize stamped/die-forged concentric and eccentric transitions from carbon steel are given in Table 10, welded transitions - in Table 11.

The use/application of the stamped/die-forged transitions is solved in conduits/manifolds on P_y to 100 kg/cm², welded - to 40 kg/cm².

Silencers/plugs and bottoms use for covering the free ends of the ducts. Standards provided for the use/application of the flanged

stamped/die-forged silencers/plugs, flat/plane and flat/plane finned bottoms. Flat/plane bottoms depending on their diameter are installed on conduits/manifolds on p_y from 2.5 to 25 kg/cm², flat/plane finned - on p_y from 10 to 25 kg/cm², and the stamped/die-forged silencers/plugs - on p_y to 100 kg/cm².

Sizes/dimensions and mass of the standardize silencers/plugs and bottoms their carbon steel are given in Tables 12, 13 and 14.

The groove preparation of all welded parts under weld is accomplished/realized in accordance with GOST 16037-70 (see Chapter XVII).

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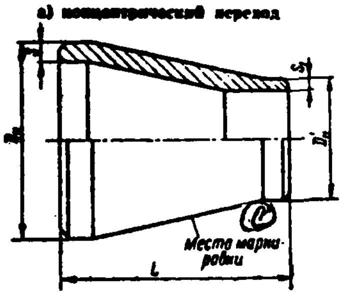
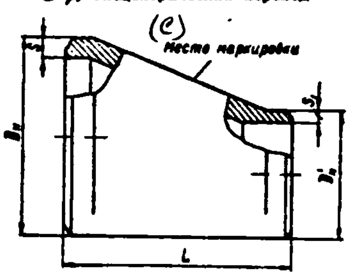
§4. Transitions from carbon steel jointless and welded.

Table 10. **Transitions concentric and eccentric jointless on P_y to 100 kg/cm² (HSN 120-69/MMSS USSR).**

а) концентрический переход



b б) эксцентрический переход



(1) Размеры в мм						(2) P_y, кгс/см², не более	(3) Масса перехода в кг	
$D_y \times D'_y$	$D_н$	$D'_н$	L	S	S_1		(4) концентрического	(5) эксцентрического
50×40	57	45	60	3,5 6	2,5 4	100 100*	0,2 0,3	0,3 —
65×40	76	45	70	3,5 6	2,5 4	64 100*	0,4 0,6	— —
65×50	76	57	70	3,5 6	3,5 6	64 100*	0,4 0,7	0,4 —
80×50	89	57	75	3,5 6 8	3,5 6 6	64 100 100*	0,5 0,8 1	0,5 — —
80×65	89	76	75	3,5 6 8	3,5 6 7	64 100 100*	0,5 0,9 1,1	0,5 — —
100×65	108	76	80	4 7	3,5 6	64 100*	0,8 1,2	0,8 —
100×80	108	89	80	4 7	3,5 6	64 100*	0,9 1,3	0,9 —
125×80	133	89	100	4 7	3,5 7	64 100	1,1 1,9	— —
125×100	133	108	100	4 5 7	4 5 7	64 64* 100	— 1,5 2	1,4 — —

TABLE 10 (cont.)

1 Размеры в мм						2 P_y, кгс/см², не более	3 Масса перехода в кг	
$D_y \times D_y'$	$D_н$	$D_н'$	L	S	S_1		4 концентрического	5 эксцентрического
150×100	159	108	130	4,5 8	4 7	40 100	2 3,3	2,1 —
150×125	159	133	130	4,5 8	4 7	40 100	2,3 3,6	2,3 —
200×125	219	133	140	7 10	4 7	40 100	4,3 6	— —
200×150	219	159	140	7 9 11	4,5 7 8	25 64 40*	4,5 5,7 6,4	4,7 — —
250×150	273	159	160	7 9 11	4,5 7 8	25 64 40*	7,2 8,9 10,2	— — —
250×200	273	219	160	7 9 11	7 8 10	25 64 40*	6,9 8,6 10,4	6,9 — —
300×200	325	219	180	10 10 14	7 8 10	64 64 64*	— 12,4 16,7	12,4 — —
300×250	325	273	180	9 10	7 9	40 64	11,9 13	— 13,1
				14	11	64*	17,9	—
350×250	377	273	300	10	9	40	23,6	23,6
350×300	377	325	300	10	10	40	25,3	25,3
400×250	426	273	350	7	7	25	21,1	—
				11	9	40	32,8	—
400×300	426	325	350	7 11	6 10	25 40*	22,4 34,9	— 34,9
400×350	426	377	350	11	10	40	37,1	37,1

Note. Pressures conventional P_y are shown for nonagressive and slightly agressive media. Transitions with P_y that noted, use for moderately aggressive media.

Key: (a). concentric transition. (b). eccentric transition. (c). Place of marking. (1). Sizes/dimensions in mm. (2). kg/cm², are not more. (3). Mass of transition in kg. (4). concentric. (5). eccentric.

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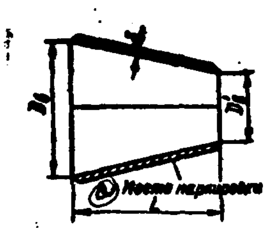
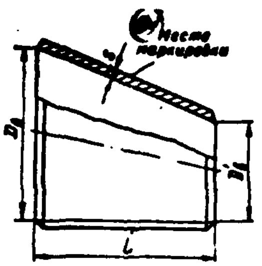
Table 11. Transitions concentric and eccentric welded on P_y to 40 kg/cm².





(1) Размеры в мм						(3) Масса в кг
$D_y \times D_y'$	$D_в$	$D_в'$	L	S	(2) $D_н \times S - D_н' \times S_1$ (присоединяемых труб)	
150×100 150×125	151	99 124	140	5	159×4,5—108×4 159×4,5—133×4	2,3 2,5
150×100 150×125	147	92 117	140	8	159×7—108×7 159×7—133×7	3,6 3,9
200×125 200×150	206	124 149	180	8	219×7—133×4 219×7—159×4,5	6,4 6,7
200×125 200×150	205	117 143	180	8	219×8—133×7 219×8—159×7	6,3 6,6
250×150 250×200	259	149 204	190	8	273×7—159×4,5 273×7—219×7	8,5 9,2
250×150 250×200	259	143 201	190	10	273×9—159×7 273×9—219×8	10,4 11,5
300×200 300×250	309	204 257	226	10	325×9—219×7 325×9—273×7	15,3 16.6

TABLE 11. (cont.)

1 Размеры в мм						3 Масса в кг
$D_y \times D_y'$	$D_в$	$D_в'$	L	S	2 $D_н \times S - D_н \times S_1$ (присоединяемых труб)	
300×150 300×200 300×250	307	143 201 253	225	10	325×10—159×7 325×10—219×8 325×10—273×9	14,1 15,3 16,1
350×250 350×300	361	255 307	300	10	377×9—273×7 377×9—325×9	24,6 25,8
350×250 350×300	359	253 303	300	10	377×10—273×9 377×10—325×10	24 26,4
400×300 400×350	408	305 357	350	10	426×10—325×9 426×10—377×9	33 34,4
400×300 400×350	406	303 355	350	12	426×11—325×10 426×11—377×10	39,6 41,3
500×350 500×400	514	357 401	600	10	530×9—377×9 530×9—426×10	65,7 70,7
500×350 500×400	506	355 402	600	14	530×14—377×10 530×14—426×11	92,9 98,9

Notes: 1. Table shows the mass of the concentric transitions; the mass of eccentric transitions to 1-3o/o is more.

2. Transitions are prepared from rolled sheet steel with one weld. Is allowed/assumed the manufacture of transitions of two halves (with two longitudinal welds).

3. Transitions from D_y to 400 mm inclusively use to conventional pressures P_y to 40 kg/cm², and with D_y 500 mm - on P_y to 16 kg/cm².

4. It is allowed/assumed to use transitions for ducts in wall thickness on 1 mm more or less indicated in Tables 11.

Key: (a).
Place of marking. (1). Sizes/dimensions in mm. (2). added ducts. (3). Mass in kg.

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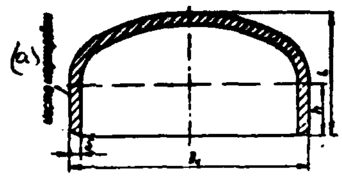
§5. Plugs and bottoms are welded.

Table 12. Silencers/plugs flanged on P_y to 100 kg/cm² (MSN 120-69/MMSS USSR).



(1) Размеры в мм				h	P_y (2) кгс/см², не более	(3) Масса в кг
D_y	$D_н$	S	L			
50	57	3,5	41	25	100	0,2
		5	42		100*	0,3
65	76	3,5	45		64	0,3
		7	47		100*	0,6
80	89	3,5	49		64	0,4
		7	51		100*	0,8
100	108	4	54		64	0,7
		7	55		100*	1,2
125	133	4	60		64	0,9
		7	62		100*	1,5
150	159	4,5	67		40	1,3
		8	69		100*	2,3
200	219	7	82	25	64	4,1
		10	100	40	100*	5,7
250	273	8	97	25	64	6
		12	114	40	64*	9,9
300	325	10	96	25	64	11,6
		14	109	40	64*	15,7
350	377	10	109	25	40	16,1
		12	109	25	64*	20,1
380	377	16	120	40	100*	28
400	426	8	121	25	25	15,4
		10	121	25	40	18,9
		12	134	40	40*	22,4
500	530	10	166	25	25	20,1

Notes: 1. Material and technical requirements - see §6 of this chapter.

2. Pressures conventional P_y are shown for nonagressive and slightly agressive media. Silencers/plugs from P_y. noted*, they use for moderately aggressive media.

Key: (a). Place of marking. (1). Sizes/dimensions in mm. (2). kg/cm², are not more. (3). Mass in kg.

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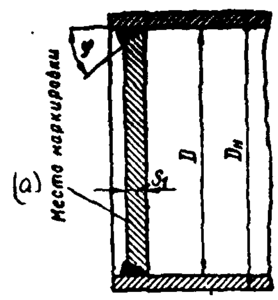
Table 13. Bottoms flat/plane on P_y to 25 kg/cm² (MN 2890-62).



(1) P_y, кгс/см²	(2) Размеры в мм					(3) Масса кг
	D_y	(4) трубы	(5) днища			
		$D_н \times S$	D	S_1	φ	
1—10 16 25	150	159×4,5	148	8 10 12	45° 30°	1,08 1,35 [illegible]
1—10 16 25	200	219×7	203	10 12 16	45° [illegible]	[illegible]
1—10 16 25	250	273×7	257	10 16 [illegible]	45° [illegible]	[illegible]
1—10 16 25	300	325×9	305	12 20 24	45° 30°	6,96 11,6 17,9
1—10 16 25	350	377×9	357	16 24 28	45° 30°	12,5 18,8 22
1 и 2,5 6 10	400	426×7	410	10 20 24	30°	10,6 21,3 25,6
1 и 2,5 6	500	530×7	514	16 24	30°	26,3 39,6
1 и 2,5 6	600	630×7	614	16 26	30°	37,8 58,5

Notes: 1. Bottoms are prepared from sheet steel according to GOST 500-58**.

2. For D_y-400 and more, P_y-16 and 25 kg/cm² and for D_y-500 and 600 mm, P_y-10 kg/cm² use finned bottoms on MN 2892-62, see Table 14.

3. Diameters of bottoms more precisely formulate according to actual tube bores taking into account gap not more than 2 mm side. Values D in Tables 13 and 14 corresponding to nominal sizes of tube bores with gap 1 mm for side.

Key: (a). Place of marking. (1). kg/cm². (2). Sizes/dimensions in mm. (3). Mass in kg. (4). duct. (5). bottom.

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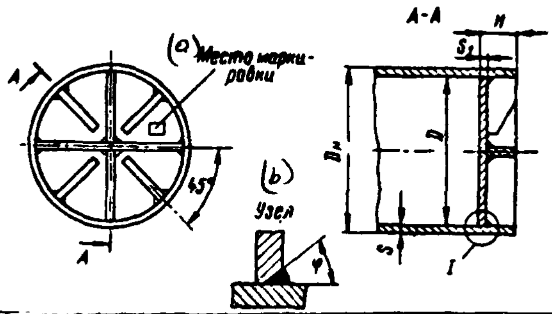
Table 14. Bottoms finned on P_y to 25 kg/cm² (ВН 2891-62).



(2) P_y, кгс/см²	(1) Размеры в мм: D_y	(3) трубы $D_н \times S$	(4) днища D	S_1	H	(5) Масса в кг
16	400	426×7	410	10	90	20,5
25	400	426×10	404	10	110	21,9
10	500	530×7	514	10	110	24,2
16				16	116	46,7
25				16	136	50,4
10	600	630×7	614	16	116	61,3
16				16	136	65,7

Key: (a). Place of marking. (b). Unit. (1). Sizes/dimensions in mm. (2). kg/cm². (3). duct. (4). bottom. (5). Mass in kg.

FOOTNOTE [1]. See note to Table 13. ENDFOOTNOTE.

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§6. Technical requirements.

1. Technical requirements for the manufacture of sharp-bend and stampings of conduits/manifolds (TU 36-933-67/MMSS USSR).

Technical requirements extend to the parts, prepared in accordance with the nomenclature of MSN 120-69/MMSS USSR).

Minmontazhspetsstroy USSR.

Material of branches, reducers, end caps and T-joints - steel brand 20 according to GOST 1050-60** end caps and reducers of steel may also be made from sheet steel brand VSt3sp according to GOST 380-71.

Manufacturing tolerances from geometric form and nominal sizes of parts must not exceed the values, indicated in Tables 15 and 16.

Deviations with respect to the outside diameter of part $D_н$ in intermediate sections/cuts must not exceed $\pm$3.5o/o of nominal value of diameter.

Wall thickness in any section/cut of part must be not less than 85o/o of nominal of the value with wall thickness to 15 mm in not less than 87.5o/o with thickness of wall of more than 15 mm.

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2. Technical requirements for manufacturing internal offtakes (MN 2912-62).

Technical requirements are propagated to the bent offtakes, prepared as commercial goods on tube-bending machines with the induction heating or any other method.

Material of offtakes - steel of brand 20 IPO GOST 1050-60*T Offtakes from electric welding ducts according to GOST 10704-63* can be also prepared from steel of the brand/mark VSt.3sp according to GOST 380-71.

Manufacturing tolerances from geometric form and sizes/dimensions of offtakes must not exceed the values, indicated in Table 17.

The wall thickness of offtakes in any place must be not less than 85o/o nominal thickness taking into account minus deviation.

The ovality of the section/cut of offtakes in the places of bend, defined as the ratio of the difference between greatest and smallest external diameters to nominal outside diameter, must not exceed 0.1 (Table 17).

The deviations of centerlines at the ends of the offtakes during their imposition mold./loft ~~[illegible]~~ must not exceed 2 mm for offtakes $D_н$<219 mm and 3 mm ~~[illegible]~~ for large-diameter offtakes.

Table 15. Manufacturing tolerances from the geometric form of stampings in mm, are not more.

(1) Допускаемые отклонения	S, мм							
	2,5—3	3,5	4,5	5	6	7—8	9—14	(2) свыше 14
(3) По $D_{вн}$ присоединительных концов	±0,5	±1,0		±1,5		±2,0	±2,5	±3,0
(4) От перпендикулярности торцов к оси детали	0,5	0,1			1,5			

Key: (1). Allowed deviation. (2). it is more than. (3). On D_{BH} leads. (4). From perpendicularity of ends/faces to axis/axle of part.

Table 16. Manufacturing tolerances with respect to structural length.

(1) Допускаемые отклонения по строительной длине	$D_н$, мм				
	45—133	159—219	273—377	426—530	(2) свыше 530
(3) Отводы, переходы, тройники	±2,0	±3,0	±4,0	±5,0	±6,0
(4) Заглушки	±4,0	±6,0			±10,0

Key: (1). Manufacturing tolerances with respect to structural length. (2). ~~it is~~ more than. (3). Offtakes, transitions, T-connections. (4). Silencers/plugs.

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Table 17. Manufacturing tolerances from the geometric form of the bent offtakes in mm, are not more.

(1) Допускаемые отклонения	$D_н$, мм					
	(2) до 57	76—133	159—194	219	273—325	(3) свыше 325
(4) Волнистость (высота гофр)	3,0	4,0	5,0	6,0	7,0	8,0
(5) Неперпендикулярность торцов к оси отвода	1,0		1,5		2,0	

Key: (1). Manufacturing tolerances. (2). to. (3). it is more than. (4). Undulation (height corrugation). (5). Nonperpendicularity of ends/faces to axis/axle of offtake.

3. Technical requirements for the manufacture of the fabricated members of conduits/manifolds (MN 2893-62).

Technical requirements are propagated to welded offtakes, sectors, half-sectors, T-connections and transitions, prepared as commercial production.

Material - steel of brand 20 according to GOST 1050-60* parts

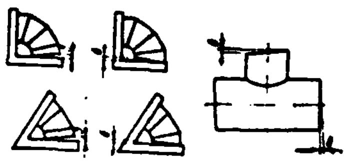
from electric welding ducts and transitions from sheet steel can be also prepared from steel of the brands/marks of St.3sp and VST.3sp according to GOST 380-71.

Manufacturing tolerances from geometric form and sizes/dimensions of fabricated members must not exceed the values, indicated in Table 18.

Deviations from the perpendicularity of the axis/axle of connecting pipe to the axis/axle of duct in T-connections must not exceed 1°.

The welds in parts must be equal, craters are welded; the edge of welds they must be coupled with base metal smoothly, without sharp transitions and rolls.

Table 18. Manufacturing tolerances from geometric forms and sizes/dimensions of fabricated members in mm, are not more.



(1) Допускаемые отклонения	$D_н$, мм					
	(2) до 219	273—325	377—426	478—720	820—1020	1220—1620
(3) От перпендикулярности плоскостей торцов к оси прохода детали, δ	1,5	2		2,5	3	4
(4) Внутренних диаметров в торцах	±1	±1,5		±2	±2,5	±3
(5) От параллельности торцов	1	1,5		2	2,5	3
(6) Несимметричность штуцера в тройниках	5				10	
(7) Строительных длин в отводах	±3		±5			

Key: (1). Manufacturing tolerances. (2). to. (3). From perpendicularity of plane surfaces to axis/axle of pass of part. (4). Bores in ends/faces. (5). From parallelism of ends/faces. (6). Dissymmetry of connecting pipe in T-connections. (7). Structural lengths in offtakes.

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Chapter IV.

FLANGES AND FLANGED PLUGS.

§1. Flanges.

Constructions/designs, sizes/dimensions and material of the basic types of the flanges of conduits/manifolds and connecting pieces, and also entrance and exit flanges of fittings, instruments, apparatuses and reservoirs are regulated by the corresponding standards.

The types of flanges on P_y from 1 to 200 kg/cm² according to GOST 1233-67 and silencers/plugs of flanged ones, their material and limits of use/application depending on the value of internal diameter and conventional pressure are given in Table 1.

Pages 100-103.

Table 1. Types of flanges (GOST 1233-67) and flanged silencers/plugs.

(a) Тип фланца	(b) Форма уплотнительной поверхности	ГОСТ	(c) Пределы применения		t, °C	(e) Номер размерной таблицы
			(d) $P_у$, кгс/см²	$D_у$, мм		
I. Литой из серого чугуна	(Ia) С соединительным выступом	1235—67	1—16	15—3000	(Id) До 300	—
	(Ib) С выступом или впадиной	12815—67*	1—16	15—800		
	(Ic) С шипом или пазом	12816—67*	1—16	15—800		
II. Литой из ковкого чугуна	(Ia) С соединительным выступом	12817—67*	16—40	15—80	(Id) До 400	—
	(Ib) С выступом или впадиной	12818—67*				
	(Ic) С шипом или пазом	12819—67*				
III. Литой стальной	(IIIa) Без выступа	12820—67*	16—40	15—1600	» 450	—
	(Ia) С соединительным выступом	12821—67*	16—25	15—1600	» 450	—
			40—200	15—800	» 530	—
	(Ib) С выступом или впадиной	12822—67*	16; 25	15—800	» 450	—
			40—200	15—800	» 530	—
	(Ic) С шипом или пазом	12823—67*	16; 25	15—800	» 450	—
			40—100	15—800	» 530	
	(IIIb) Под линзовую прокладку	12824—67*	64—200	15—400	» 530	—
(III.) Литой стальной	(IIIc) Под прокладку овального сечения	12825—67*	64—200	15—400	(Ia) До 530	—
IV. Стальной с шейкой на резьбе	(IIIa) Без выступа	12826—67	1—16	10—150	» 300	2; 3; 4, 6 11
	(Ia) С соединительным выступом	1245—67	1—16	10—150	» 300	2; 3; 4; 6; 11
V. Стальной плоский приварной	(IIIa) Без выступа	12827—67*	1—25	10—1600	» 300	2—6; 12; 13
	(Ia) С соединительным выступом	1255—67*	1—25	10—1600	» 300	
	(Ib) С выступом или впадиной	12828—67*	1—25	10—800	» 300	2—6; 12; 13
VI. Стальной приварной встык	(IIIa) Без выступа	12829—67*	1—40 1—25	10—1600 10—1600	» 450 » 450	2—10; 14; 15
	(Ia) С соединительным выступом	12830—67*	40—200	10—800	» 530	2—10; 14; 16

VI. Стальной приварной встык	Ib С выступом или впадиной	12831—67*	1—25	10—800	До 450	2—10; 14; 17
			40—200	10—500	» 530	
	Ic С шипом или пазом	12832—67*	1—25	10—800	» 450	2—10; 14; 18
			40—200	10—500	» 530	
	IIIc Под прокладку овального сечения	12833—67*	64—200	10—400	» 530	2—10; 14; 19
	IIIb Под линзовую прокладку	12835—67*	64—200	10—400	» 530	
VII. Стальной свободный на приварном кольце	Ia С соединительным выступом	1268—67*	1—25	10—500		2—6; 19; 20; 21
	Ib С выступом или впадиной	12834—67*			» 300	
VIII. Стальной свободный на отбортованной трубе	Ia С соединительным выступом	1272—67	1; 2; 5; 6	10—500		
IX. Заглушки фланцевые стальные	Ia с соединительным выступом	12836—67*	1—25	10—1600	450	2—9; 22; 23
			40	10—600	530	
	IIa с выступом	12837—67*	40—200	10—500	530	2—9; 22; 24
	IIb с шипом	12838—67*	1—25	10—500	450	2—9; 22; 25
			40		530	
	IIIc под прокладку овального сечения	12839—67*	64; 100	10—400	530	2—9; 22; 26

Note. The data about the flanges of pressure piping (on P_y =200—1000 kg/cm²) see in chapter VI.

Key: (a). Type of flange. (b). Form of packing surface. (c). Limits of use/application. (d). kg/cm². (e). Number of dimensional table.

(I). Poured from gray cast iron. (Ia). With uniting projection. (Ib). With projection or hollow. (Ic). With journal or slot/groove. (Id). To. (II). Poured from malleable cast iron. (III). By poured steel. (IIIa). Without projection. (IIIb). under lens ply. (IIIc). under the ply of oval section/cut. (IV). Steel with neck on thread. (V). Steel flat/plane welded. (VI). steel welded butt. (VII). Steel free on welded ring. (VIII). Steel free on flanged duct. (IX). Silencers/plugs flanged steel. (IXa). with projection. (IXb). with journal.

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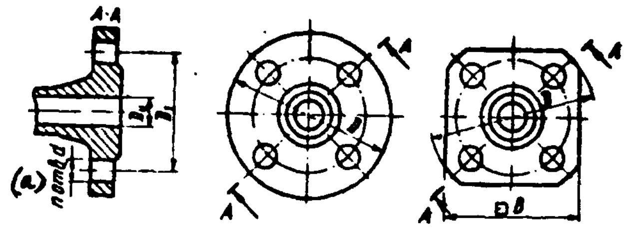
For the purpose the safeguards of interchangeability of the flanges of all types their coupling dies (outside diameter, diameter of bolt circumference, quantity and diameter of bolt holes) are standardized and established/installed identical for one and the same conventional pressures and internal diameters independent of construction/design and material of flange (Table 2 and 3)).

Table 2. The coupling dies of flanges in mm (GOST 1234-67).



D_y	P_y=1 и 2,5 кгс/см² D	B	D_1	d	n	P_y=6 кгс/см² D	B	D_1	d	n
10	75	60	50	12	4	75	60	50	12	4
15	80	65	55			80	65	55		
20	90	70	65			90	70	65		
25	100	75	75			100	75	75		
32	120	95	90	14		120	95	90	14	
40	130	100	100			130	100	100		
50	140	110	110			140	110	110		
65	160	125	130			160	125	130		
80	185	140	150	18		185	140	150	18	
100	205	155	170			205	155	170		
125	235	—	200		8	235	—	200		8
150	260	—	225			260	—	225		

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Continuation Table 2.

D_y	P_y=1 и 2,5 кгс/см^2					P_y=6 кгс/см^2				
	D	B	D_1	d	n	D	B	D_1	d	n
200	315	—	280	18	8	315	—	280	18	8
250	370	—	335		12	370	—	335		
300	435	—	395	23		435	—	395	23	12
350	485	—	415			495	—	445		
400	535	—	495		16	533	—	495		16
500	640	—	600			640	—	600		
600	755	—	705	27	20	755	—	705	27	20
800	975	—	920	30	24	975	—	920	30	24
1000	1175	—	1120		28	1175	—	1120		28
1200	1375	—	1320		32	1400	—	1340	33	32
1400	1675	—	1520		36	1620	—	1560		36
1600	1785	—	1730		40	1820	—	1760		40

Continuation Table 2.

D_y	P_y=10 кгс/см^2					P_y=16 кгс/см^2				
	D	B	D_1	d	n	D	B	D_1	d	n
10	90	70	60	14	4	90	70	60	14	4
15	95	75	65			95	75	65		
[illegible]	105	80	75			105	80	75		
[illegible]	[illegible]	[illegible]	85			115	90	85		
[illegible]	[illegible]	[illegible]	100	18		135	105	100	18	
[illegible]	[illegible]	[illegible]	110			145	110	110		

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Continuation Table 2.

D_y	P_y=10 kgf/cm²					P_y=16 kgf/cm²				
	D	B	D_1	d	n	D	B	D_1	d	n
50	160	125	125	18	4	160	125	125	18	4
65	180	140	145	18	4	180	140	145	18	4
80	195	150	160	18	4	195	150	160	18	4
100	215	—	180	18	8	215	—	180	18	8
125	245	—	210	18	8	245	—	210	18	8
150	280	—	240	23	8	280	—	240	23	8
200	335	—	295	23	8	335	—	295	23	12
250	390	—	350	23	12	405	—	355	27	12
300	440	—	400	23	12	460	—	410	27	12
350	500	—	460	23	16	520	—	470	27	16
400	565	—	515	27	16	580	—	525	30	16
500	670	—	620	27	20	710	—	650	33	20
600	780	—	725	30	20	840	—	770	40	20
800	1010	—	950	33	24	1020	—	950	40	24
1000	1220	—	1160	33	28	1255	—	1170	46	28
1200	1455	—	1380	40	32	1485	—	1390	52	32
1400	1675	—	1590	43	36	1685	—	1590	52	[illegible]
1600	1915	—	1820	52	40	1925	—	[illegible]	[illegible]	[illegible]

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HANDBOOK ON SPECIAL WORKS. TECHNOLOGICAL LINES OF INDUSTRIAL EN--ETC(U)

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Continuation Table 2.

D_y	P_y=25 kgf/cm^2					P_y=40 kgf/cm^2				
	D	B	D_1	d	n	D	B	D_1	d	n
10	90	70	60	14	4	90	70	60	14	4
15	95	75	65			95	75	65		
20	105	80	75			105	80	75		
25	115	90	85			115	90	85		
32	135	105	100	18		135	105	100	18	
40	145	110	110			145	110	110		
50	160	125	125			160	125	125		
65	180	—	145		8	180	—	145		8
80	195	—	160			195	—	160		
100	230	—	190	23		230	—	190	23	
125	270	—	220	27		270	—	220	27	
150	300	—	250			300	—	250		
200	360	—	310		12	375	—	320	30	12
250	425	—	370	30		445	—	385	33	
300	485	—	430		16	510	—	450		16
350	550	—	490	33		570	—	510		
[illegible]	610	—	550			665	—	585	40	
[illegible]	730	—	660	40	20	735	—	670	43	20
[illegible]	[illegible]	—	770			890	—	795	52	
[illegible]	[illegible]	—	[illegible]	46	[illegible]	1165	—	1030	58	24
[illegible]	[illegible]		1200	58	[illegible]	—	—	—	—	—

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Continuation Table 2.

D_y	P_y=25 кгс/см²					P_y=40 кгс/см²				
	D	B	D_1	d	n	D	B	D_1	d	n
1200	1525	—	1410	58	32	—	—	—	—	—
1400	1750	—	1640	62	36	—	—	—	—	—

Continuation Table 2.

<table>
<tr><th rowspan="2">D_y</th><th colspan="4">P_y=64 кгс/см²</th><th colspan="4">P_y=100 кгс/см²</th></tr>
<tr><th>D</th><th>D_1</th><th>d</th><th>n</th><th>D</th><th>D_1</th><th>d</th><th>n</th></tr>
<tr><td>10</td><td>100</td><td>70</td><td rowspan="2">14</td><td rowspan="7">4</td><td>100</td><td>70</td><td rowspan="2">14</td><td rowspan="7">4</td></tr>
<tr><td>15</td><td>105</td><td>75</td><td>105</td><td>75</td></tr>
<tr><td>20</td><td>125</td><td>90</td><td rowspan="2">18</td><td>125</td><td>90</td><td rowspan="2">18</td></tr>
<tr><td>25</td><td>135</td><td>100</td><td>135</td><td>100</td></tr>
<tr><td>32</td><td>150</td><td>110</td><td rowspan="5">23</td><td>150</td><td>110</td><td rowspan="2">23</td></tr>
<tr><td>40</td><td>165</td><td>125</td><td>165</td><td>125</td></tr>
<tr><td>50</td><td>175</td><td>135</td><td>195</td><td>145</td><td rowspan="3">27</td></tr>
<tr><td>65</td><td>200</td><td>160</td><td rowspan="5">8</td><td>220</td><td>170</td><td rowspan="4">8</td></tr>
<tr><td>80</td><td>210</td><td>170</td><td>230</td><td>180</td></tr>
<tr><td>100</td><td>250</td><td>200</td><td>27</td><td>265</td><td>210</td><td>30</td></tr>
<tr><td>125</td><td>295</td><td>240</td><td>30</td><td>310</td><td>250</td><td rowspan="2">33</td></tr>
<tr><td>150</td><td>340</td><td>280</td><td rowspan="2">33</td><td>350</td><td>290</td><td rowspan="3">12</td></tr>
<tr><td>200</td><td>405</td><td>345</td><td rowspan="2">12</td><td>430</td><td>360</td><td rowspan="2">40</td></tr>
<tr><td>250</td><td>470</td><td>400</td><td rowspan="3">40</td><td>500</td><td>430</td></tr>
<tr><td>300</td><td>530</td><td>460</td><td rowspan="2">16</td><td>585</td><td>500</td><td>46</td><td rowspan="2">16</td></tr>
<tr><td>350</td><td>595</td><td>525</td><td>655</td><td>560</td><td>52</td></tr>
</table>

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Continuation Table 2.

D_y	P_y=64 кгс/см²				P_y=100 кгс/см²			
	D	D_1	d	n	D	D_1	d	n
400	670	585	46	16	715	620	52	16
500	800	705	52	20	—	—	—	—
600	985	820	58		—	—	—	—

Continuation Table 2.

D_y	P_y=160 кгс/см²				P_y=200 кгс/см²			
	D	D_1	d	n	D	D_1	d	n
10	100	70	14	4	120	82	23	4
15	105	75						
20	125	90	18		130	90		
25	135	100			150	102	27	
32	150	110	23		160	115		
40	165	125			170	124		
50	195	145	27		210	160		8
65	220	170		8	260	203	30	
80	230	180			290	230	33	
100	265	210	30		360	292	40	
125	310	250	33		385	318		12
150	350	290		12	440	360	46	
[illegible]	[illegible]	360	40		535	440	52	

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Continuation Table 2.

D_y	P_y=100 kg/cm² (2)				P_y=200 kg/cm² (2)			
	D	D_1	d	n	D	D_1	d	n
250	500	430	40	12	670	572	58	16
300	585	500	46	16	—	—	—	—

Note. The connecting sizes/dimensions of the flanges of fittings, connecting pieces and conduits/manifolds, which work under conditions of vacuum, if there are no special requirements, and also at operating pressure $P_{p\leq}$ to 1 kg/cm² are accepted on P_y=1 and 2.5 kg/cm².

(a). hole

Key: (1). and. (2). kg/cm².

Table 3. Nominal thread diameter of bolts or pins for flange joints in mm.

(1) Диаметр отверстия d	12	14	18	23	27	30	33	40	46	[illegible]	[illegible]	62
(2) Номинальный диаметр резьбы болта или шпильки	10	12	16	20	24	27	30	36	42	48	52	56

Key: (1). Diameter of hole. (2). Nominal thread diameter of bolt or pin.

Depending on pressure in conduit/manifold and properties of the

transported medium the flanges of all types can be manufactured from with various forms packing surface, provided for by the appropriate standard for flanges (Table 4-10).

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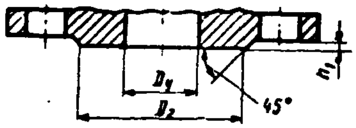
Table 4. Sizes/dimensions of flanges with uniting projection in mm (GOST 1245-67; 1255-67*; 12830-67*).



D_y	P_y, kgf/cm²								
	1; 2,5	6	10	16	25	40	64	100; 160	200
	D_2								
10	35	35	40	40	40	40	50	50	—
15	40	40	45	45	45	45	55	55	[illegible]
20	50	50	58	58	58	58	68	68	63
25	60	60	68	68	68	68	78	78	73
32	70	70	78	78	78	78	85	85	86
40	80	80	88	88	88	88	96	96	91
50	90	90	102	102	102	102	108	115	129
65	110	110	122	122	122	122	132	140	167
80	128	128	138	138	138	138	142	150	190
100	148	148	158	158	162	162	170	175	245
125	178	178	188	188	188	188	205	210	271
150	202	202	212	212	218	218	240	250	306
200	258	258	268	268	278	280	300	315	380
250	312	312	320	320	335	345	355	380	508
300	365	365	370	378	390	410	415	445	—
350	415	415	430	435	450	465	475	500	—
400	465	482	465	490	505	535	525	560	—
500	570	570	585	610	615	615	—	—	—
600	670	670	685	720	720	—	—	—	—
[illegible]	[illegible]	[illegible]	905	900	930	—	—	—	—
[illegible]	[illegible]	[illegible]	1110	1110	—	—	—	—	—
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—	—	—

continuation Table 4.

1400	1460	1510	–	–	–	–	–	–	–
1600	1690	–	–	–	–	–	–	–	–

Notes: 1. Size/dimension h_1 - see Table 6.

2. Flanges with D_y-350 and 400 mm use to P_y not more than 100 kg/cm².

Key: (1). kg/cm².

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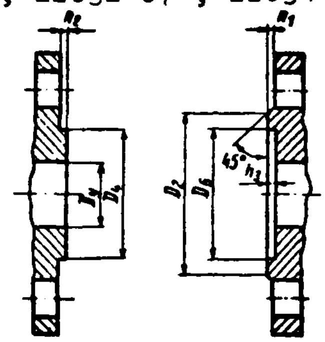
Table 5. Sizes/dimensions of male flanges or hollow in mm (GOST 12828-67*; 12831-67*; 12834-67*).



D_y	P_y, кгс/см² (1)					
	1; 2,5; 6		(2) от 10 (3) до 160 вкл. (4)		200	
	D_4	D_6	D_4	D_6	D_4	D_6
10	29	30	34	35	—	—
15	33	34	39	40	27	[illegible]
20	43	44	50	51	34	35
25	51	52	57	[illegible]	41	[illegible]
32	[illegible]	[illegible]	65	66	49	50
40	[illegible]	70	75	76	55	56
50	80	81	87	88	69	70
65	100	101	109	110	96	97
80	115	116	120	121	115	116
100	137	138	149	150	137	138
125	166	167	175	176	169	170
150	191	192	203	204	189	190
200	249	250	259	260	244	245
250	303	304	312	313	318	319
300	356	357	363	364	—	—
350	403	407	421	422	—	—
400	456	457	473	474	—	—
500	561	562	575	576	—	—
600	661	662	677	678	—	—
800	867	868	877	878	—	—

Note. The sizes/dimensions: D_2 - see Table 4; h_1, h_2 and h_3 - see Table 6.

Key: (1). kg/cm². (2). from. (3). to. (4). incl. [redacted].

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Table 6. Height of uniting projection, projection and hollow of flanges in mm.

D_y	P_y, (1)				
	1—[illegible]	1—100	200	1—100	200
	h	h_1		h_2	
	[illegible]	4	5	3	4
40—80	3	4	5	3	4
100—250	3	4	6	3	5
300—500	4	5	—	4	—
600—800	5	6	—	5	—
900—1600	5	—	—	—	—

Key: (1). kg/cm².

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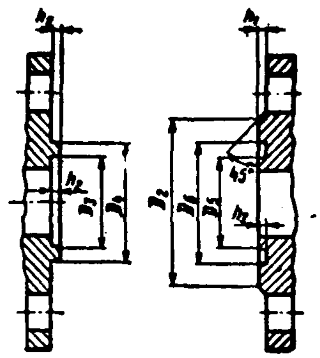
Table 7. Sizes/dimensions of flanges with journal or slot/groove in mm (GOST 12832-67*).



D_y	P_y, kgf/cm²				D_y	P_y, kgf/cm²			
	1; 2; 5; 6		10—100			1; 2; 5; 6		10—100	
	D_3	D_5	D_3	D_5		D_3	D_5	D_3	D_5
10	19	18	24	23	25	41	40	43	42
15	23	22	29	28	32	49	48	51	50
20	33	32	36	35	40	56	54	61	60
50	66	65	73	72	250	283	282	292	291
65	86	85	95	94	300	336	336	343	342
80	101	100	106	105	350	385	386	395	394
100	117	116	129	128	400	436	435	447	446
125	146	145	155	154	500	541	540	549	548
150	171	170	183	182	600	636	634	651	650
200	229	228	239	238	800	841	840	851	850

Notes: 1. Sizes/dimensions D_2, D_4 and D_6 - see Table 4 and Table 5.

2. Sizes/dimensions h_1, h_2 and h_3 - see Table 6.

For P_y=40 kg/cm² are used the flanges only to D_y=500 mm inclusively; for P_y=64-100 kg/cm² - to D_y=400 mm incl.

Key: (1). kg/cm².

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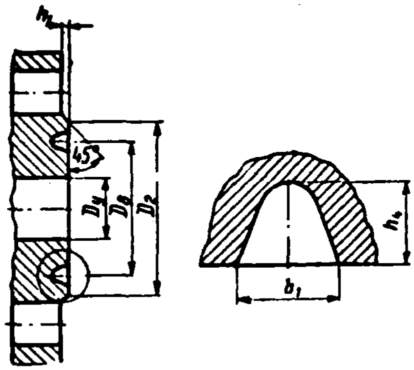
Table 8. Sizes/dimensions of flanges under the ply of oval section/cut in mm (GOST 12833-67*).



D_y	P_y, кгс/см² (1)			D_y	P_y, кгс/см² (1)		
	64; 100	160	200		64; 100	160	200
	D_6				D_6		
[illegible]	35	—	—	16	35	35	40
20	45	45	45	125	175	[illegible]	[illegible]
25	50	50	50	150	205	[illegible]	240
32	65	65	65	200	265	275	[illegible]
40	75	75	75	250	320	330	—
50	85	95	95	300	375	380	—
65	110	110	130	350	420	—	—
80	115	130	160	400	480	—	—
100	145	160	190	—	—	—	—

Note. Sizes/dimensions D_2 and h_1 - see in Table 4 and 6; b_1 and b_4 in table 9.

Key: (1). kg/cm².

Table 9. Sizes/dimensions of cannelure under the ply of oval section/cut in mm (GOST 12833-67*).

D_y	P_y, кгс/см² (1)							
	64	100	160	200	64	100	160	200
	b_1				h_1			
10—40	9		9	9	6,5		6,5	6,5
50—100	12		12	12	8		8	8
125				14				10
150			14	17			10	11
200			17				11	
250				—				—
300			23				14	
350; 400	12	17	—		8	11	—	

Note. For P_y-100 and 200 kg/cm² flanges D_y-10 mm do not use.

Key: (1). kg/cm².

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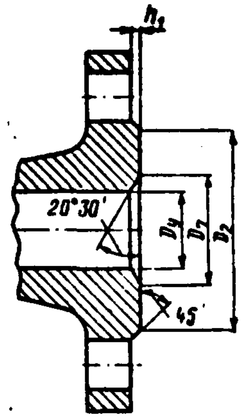
Table 10. Sizes/dimensions of flanges under lens ply mm (GOST 12835-67*).



D_y	P_y, кгс/см² (1): 64; 100	160	200	D_y	P_y, кгс/см² (1): 64; 100	160	200
	D_7				D_7		
10	18	—	—	100	124	124	115
15	24	24	28	125	153	153	145
20	30	30	32	150	181	181	175
25	35	35	37	200	243	243	225
32	43	43	43	250	298	298	—
40	52	52	55	300	345	345	—
50	63	63	63	350	394	—	—
65	86	85	90	400	445	—	—
80	97	97	97	—	—	—	—

Note. Sizes/dimensions D_4 and h_1 - see in tables 4 and 6.

Key: (1). kg/cm².

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Flanges without projection are used for pressures to 40 kg/cm² depending on the type of flange.

Flanges with uniting projection are most general-purpose and are used in the majority of conduits/manifolds on P_y to 200 kg/cm² (flanges welded butt) or to 25 kg/cm² (remaining types of flanges).

Flanges with packing surfaces "projection - hollow" and "journal - slot/groove" use on the conduits/manifolds where is required the high density of connection or are transported products with the high penetrating power (ammonia, Freon, etc.), toxic, with fire dangerously explosive substances, and also on the conduits/manifolds, which work in vacuum.

Flanges with packing surface under lens and ring gaskets are used in conduits/manifolds on P_y from 64 to 200 k/cm².

basic dimensions and weight of the flanges of different types are given in Table 11-21.

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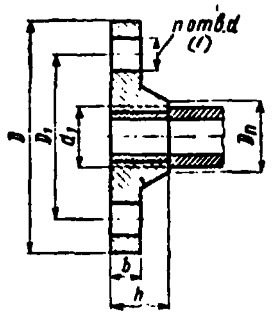
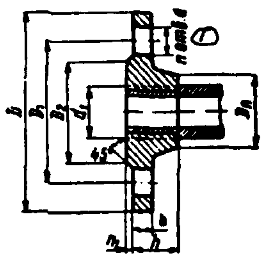
Table 11. Flanges are steel with neck on thread on P_y from 1 to 16 kg/cm².

а) Без выступа (ГОСТ 12826—67)



б) С соединительным выступом (ГОСТ 1245—67)



(2) Размеры в мм						(3) Масса фланца в кг	
D_y	(4) d_1, дюймы	D	b	h	D_n	(5) без выступа	(6) с соединительным выступом
P_y = 1; 2,5 и 6 кгс/см² (7) (8)							
10	$^3/_8$	75	10	18	23	0,31	0,32
15	$^1/_2$	80			28	0,35	[illegible]
20	$^3/_4$	90	11	22	37	0,52	[illegible]

Размеры в мм						Масса фланца в кг	
D_y	d_T дюймы	D	b	h	$D_н$	без выступа	с соединительным выступом
25	1	100	11	22	42	0,63	0,65
32	1¹/₄	120		24	50	0,9	0,93
40	1¹/₂	130			56	1,05	1,1
50	2	140		26	72	1,23	1,29
65	2¹/₂	160		27	84	1,5	1,6
80	3	185	13	29	96	2,26	2,4
100	4	205		33	122	2,65	2,79
125	5	235		35	150	3,3	3,48
150	6	260			176	3,84	4,04
P_y = 10 и 16 кгс/см²							
10	³/₈	90	12	18	26	0,54	0,56
15	¹/₂	95			30	0,6	0,62
20	³/₄	105		22	38	0,77	0,79
25	1	115			48	0,93	0,96
32	1¹/₄	135	13	24	56	1,44	1,39
40	1¹/₂	145			66	1,57	1,64
50	2	160	15	25	76	2,11	2,2
65	2¹/₂	180		29	96	2,73	2,84
80	3	195	17	31	112	3,56	3,68
100	4	215		37	132	3,98	4,12
125	5	245	19	39	164	5,61	5,78

Note: 1. Coupling dies D_1, d and n - see in Table 2.

2. Nominal diameter of thread of bolts or pins - see in Table 3.

3. Sizes/dimensions of connecting projection D_2 and h_1 - see in tables 4 and 6.

4. Material - see Table 27.

5. (illegible) flanges tube cylindrical according to GOST 6357-52, class 3.

Key: (a). Without projection (GOST 12826-67). (b). With uniting projection (GOST 1245-67). (1). Opening. (2). Sizes/dimensions in mm. (3). Mass of flange in kg. (4). inches. (5). without projection. (6). with uniting projection. (7). and. (8). kg/cm².

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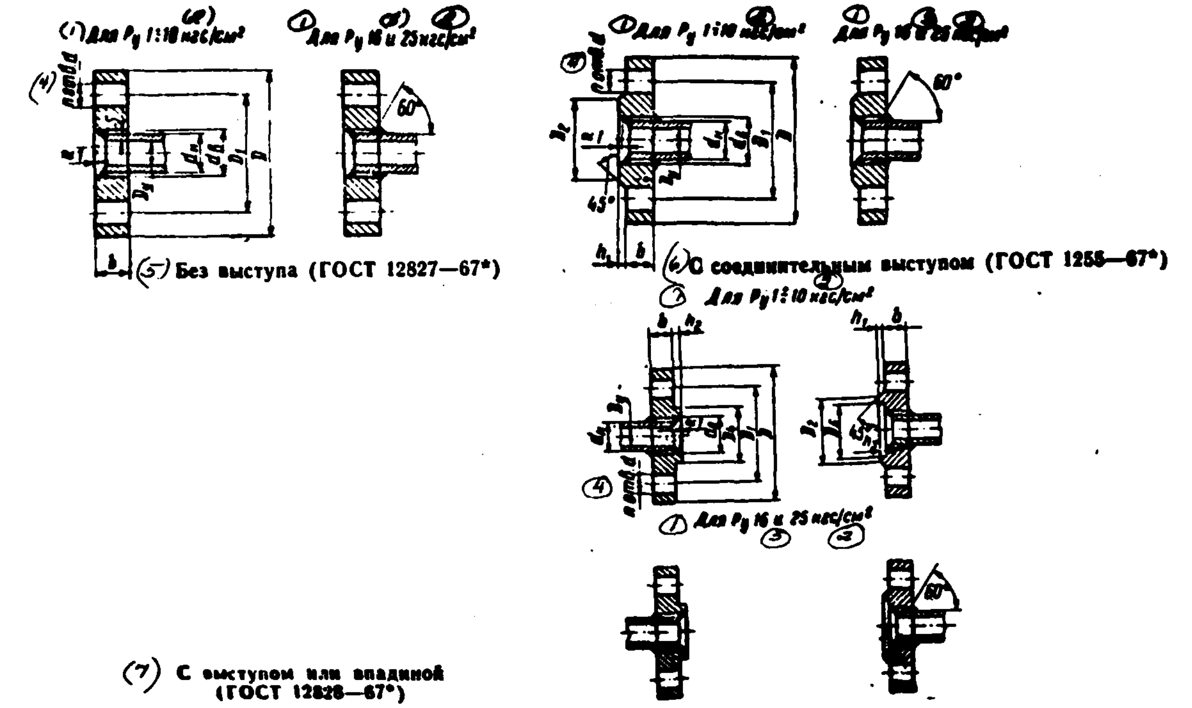
Table 12. Flanges steel flat/plane welded on P_y from 1 to 25 kg/cm².



Key: (1). For. (2). kg/cm². (3). and. (4). opening. (5). Without projection (GOST 12827-67*). (6). With uniting projection (GOST 1255-67*). (7). With projection or hollow (GOST 12828-67*).

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Continuation Table 12.

(1) Размеры в мм					(2) Масса в кг фланца			
D_y	$d_н$	$d_в$	D	b	(3) без выступа	(4) с соединительным выступом	(5) с выступом	(6) с впадиной
(7) $P_y = 1;\ 2{,}5$ кгс/см²								
10	14	15	75	8	0,24	0,25	0,25	0,24
15	18	19	80		0,27	0,29	0,29	0,27
20	25	26	90	10	0,42	0,45	0,45	0,42
25	32	33	100		0,51	0,55	0,55	0,52
32	38	39	120		0,75	0,79	0,79	0,75
40	45	46	130		0,85	0,95	0,93	0,9
50	57	59	140		0,95	1,04	1,02	0,98
65	76	78	160	11	1,27	1,39	1,37	1,32
80	89	91	185		1,67	1,84	1,79	1,74
100	108	110	205		1,94	2,14	2,11	2,01
125	133	135	235		2,33	2,6	2,56	2,42
150	159	161	260	13	3,13	3,43	3,39	3,23
200	219	222	315	15	4,38	4,73	4,60	4,48
250	273	273	370	18	6,49	6,95	6,92	6,62
300	325	325	435		8,57	9,33	9,22	8,79
350	377	377	485		9,63	10,45	10,33	9,87
400	426	426	535		9,69	11,64	11,51	9,96
500	530	530	640	20	14,82	16,01	15,86	15,15
600	630	630	755		19,54	21,35	21,03	20,08
800	820	820	975	21	33,22	36,63	36,15	34,14
1000	1020	1020	1175	25	48,32	52,58	—	—
1200	1220	1220	1375		57,26	62,26	—	—
[illegible]	1420	1420	1575	27	74	77,6	—	—

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Continuation table 12.

				$P_y = 6$ кгс/см²				
10	14	15	75	10	0,30	0,31	0,31	0,3
15	18	19	80		0,32	0,33	0,33	0,32
20	25	26	90	12	0,51	0,55	0,53	0,51
25	32	33	100		0,62	0,64	0,64	0,61
32	38	39	120	13	0,97	1,01	1,02	0,98
40	45	46	130		1,12	1,21	1,19	1,16
50	57	59	140		1,23	1,33	1,3	1,27
65	76	78	160		1,5	1,63	1,6	1,55
80	89	91	185	15	2,28	2,44	2,4	2,35
100	108	110	205		2,65	2,86	2,81	2,72
125	133	135	235	17	3,61	3,88	3,84	3,7
150	159	161	260		4,1	4,39	4,36	4,19
200	219	222	315	19	5,55	5,89	5,86	5,65
250	273	273	370	20	7,21	7,67	7,64	7,34
300	325	325	435		9,53	10,28	10,18	9,74
350	377	377	485	22	11,76	12,58	12,45	12
400	426	426	535	24	14,26	15,2	15,07	14,53
500	530	530	640	25	18,53	19,72	19,59	18,86
600	630	630	755		24,42	26,24	25,91	24,96
800	820	820	975	27	42,73	46,14	46,66	43,85
1000	1020	1020	1175	31	60,15	64,28	—	—
				$P_y = 10$ кгс/см²				
10	14	15	80	10	0,44	0,46	0,46	0,44

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Continuation Table 12.

15	18	19	95	10	0,49	0,51	0,51	0,49
20	25	26	105	12	0,71	0,74	0,75	0,71
25	32	33	115		0,84	0,89	0,89	0,84
32	38	39	135	14	1,33	1,4	1,39	1,34
40	45	46	145	15	1,63	1,71	1,72	1,67
50	57	59	160		1,93	2,06	2,03	1,99
65	76	78	180	17	2,62	2,8	2,77	2,69
80	89	91	195		2,98	3,19	3,13	3,08
100	108	110	215	19	3,69	3,96	3,94	3,76
125	133	136	245	21	5,08	5,4	5,38	5,18
150.	159	161	280		6,25	6,62	6,62	6,33
200	219	222	335	21	7,6	8,05	8,04	7,71
250	273	273	390	23	10,1	10,65	10,66	10,22
300	325	325	440	24	12,08	12,9	12,89	12,21
350	377	377	500	26	14,71	15,85	15,79	14,93
400	426	426	565		20,21	21,56	21,51	20,49
500	530	530	670	28	26,48	27,7	28,02	26,86
600	630	630	780	31	36,98	39,4	39,26	37,48
				P_y=16 кгс/см²				
10	14	15	90	12	0,52	0,54	0,54	0,53
15	18	19	95		0,58	0,61	0,61	0,58
20	25	26	105	14	0,83	0,86	0,83	0,83
25	32	33	115	16	1,12	1,17	1,17	1,12
[illegible]	38	39	135		1,[illegible]	1,[illegible]	1,[illegible]	1,[illegible]

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Continuation Table 12.

40	45	46	145	17	1,85	1,95	[illegible]	[illegible]
50	57	59	160	19	2,44	2,58	2,54	2,5
65	76	78	180	21	3,34	3,42	3,38	3,3
80	89	91	195		3,68	3,71	3,71	3,7
100	108	110	215	23	4,66	4,73	4,72	4,53
125	133	135	245	25	6,2	6,38	6,38	6,15
150	159	161	280		7,44	7,81	7,81	7,52
200	219	222	335	27	9,77	10,1	10,21	9,88
250	273	273	405	28	13,94	14,49	14,48	14,06
300	325	325	460		16,79	17,78	17,59	17,12
350	377	377	530	30	21,86	[illegible]	22,65	21,99
400	426	426	580	34	29,46	31	30,76	29,94
500	530	530	710	44	54,64	57,01	56,17	55,74
600	630	630	840	45	76,76	80,3	79,03	78,8
7 $P_y = 25$ кгс/см²								
10	14	15	90	14	0,61	0,63	0,64	0,61
15	18	19	95		0,68	0,7	0,71	0,68
20	25	26	105	16	0,94	0,98	0,97	0,94
25	32	33	115		1,12	1,17	1,17	1,13
32	38	39	135	18	1,71	1,77	1,76	1,72
40	45	46	145	19	2,06	2,18	2,15	2,11
50	57	59	160	21	2,7	2,71	2,8	2,76
65	76	78	180		3,07	[illegible]	[illegible]	3,14
80	89	91	195	23	[illegible]	[illegible]	4	[illegible]

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Continuation Table 12.

100	108	110	230	26	5,64	5,88	5,80	5,72
125	133	135	270	27	8,13	8,26	8,26	8,23
150	159	161	300		9,7	10,12	10,07	9,83
200	219	222	360	29	12,8	13,34	13,24	13,01
250	273	273	425	31	18,8	18,9	18,78	18,52
300	325	325	485	32	22,73	23,95	23,53	23,29
350	377	377	550	38	33,49	34,35	34,57	34,18
400	426	426	610	40	42,71	44,62	44,01	43,86
500	530	530	730	46	65,1	67,3	66,63	66,36

Notes: 1. Coupling dies D_1, d and n - see in Table 2.

2. Nominal thread diameter of bolts or pins - see in Table 3.

3. Sizes/dimensions: uniting projection D_2 and h_1; projection and hollow D_4, D_6, h_2 and h_3 - see in tables 4, 5 and 6.

4. Size/dimension of perpendicular of weld and wall thickness of duct must be determined by projecting/designing organization during strenth calculation. The recommended sizes/dimensions of the perpendicular of the weld - see in Table 13.

5. Material - see in Table 27.

6. For flanges with $D_y>250$ mm is allowed/assumed boring of bore of flange according to actual outside diameter of duct with gap to side not more than 2.5 mm.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg. of flange. (3). without projection. (4). with uniting projection. (5). with projection. (6). with hollow. (7). kg/cm².

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Data about flanged silencers/plugs on $P_y = 1-200$ kg/cm² are given in Table 22-26.

Materials for manufacturing of flanges, flanged silencers/plugs and fasteners depending on the temperature and pressure in conduits/manifolds are selected in accordance with table 27 and 28.

Table 13. Recommended sizes/dimensions of the perpendicular of the weld with victuals of flat/plane flanges in mm.

D_y, мм	10—20	25—50	65—150	175	200	225	250; 300	350—1000	1200	1400	1600
h	3	4	5	6	7	8	9	10	11	12	13

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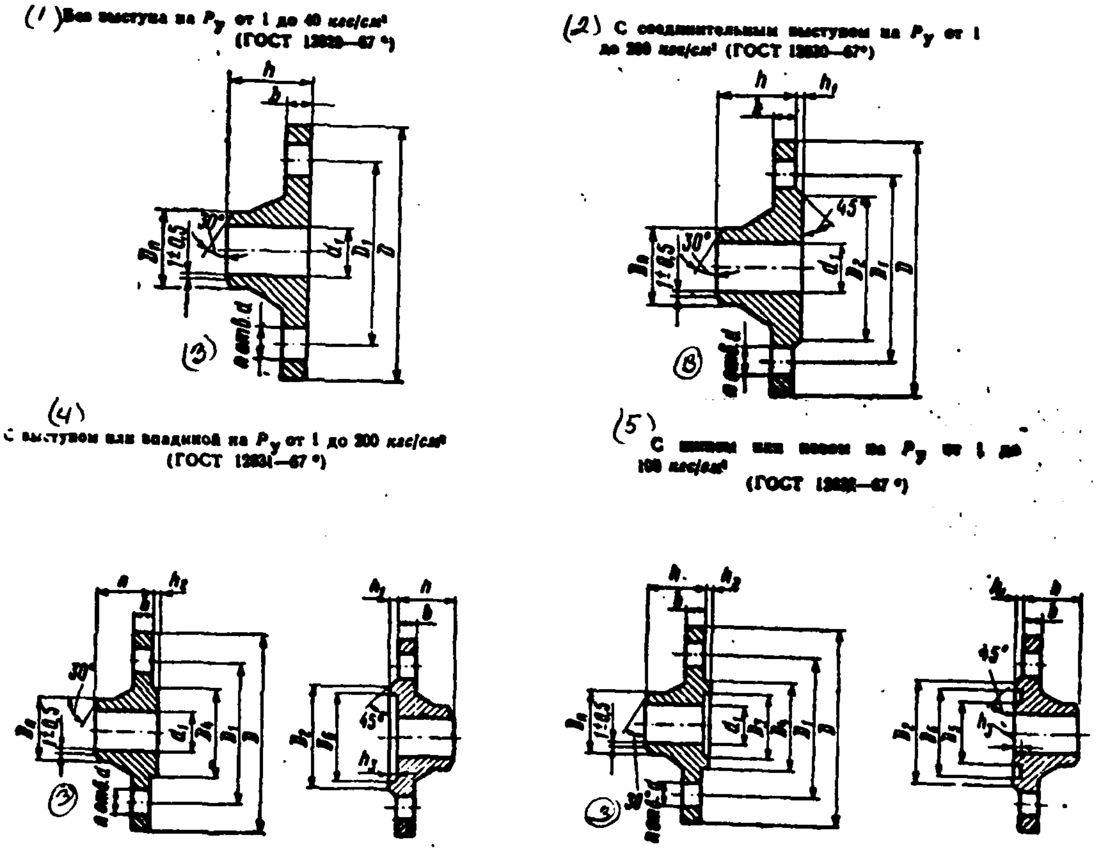
Table 14. Sizes/dimensions of the flanges of steel welded ones butt in mm.



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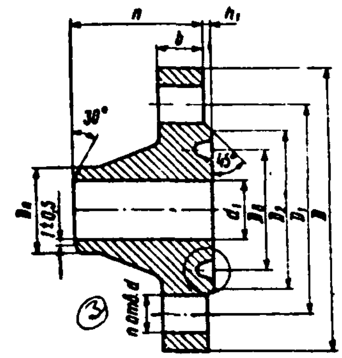
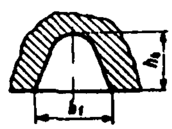
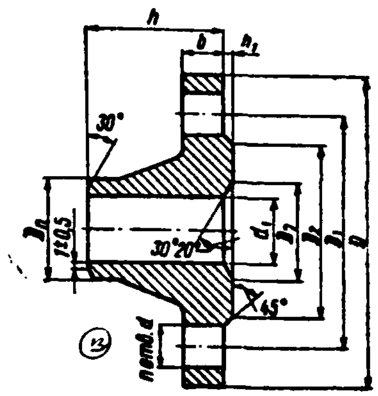
Continuation Table 14.

(6) Под прокладку овального сечения на P_y от 64 до 200 кгс/см²
(ГОСТ 12833—67 *)





(7) Под линзовую прокладку на P_y от 64 до 200 кгс/см²
(ГОСТ 12835—67 *)



D_y	$d_н$	d_1	$D_н$	P_y=1; 2,5 кгс/см² (8)			P_y=6 кгс/см² (8)		
				D	b	h	D	b	h
10	14	8	15	75	8	28	75	10	27
15	18	12	19	80		26	80		28
20	25	18	26	90		28	90		29

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Continuation Table 14.

D_y	$d_н$	d_1	$D_н$	P_y=1; 2.5 kgf/cm² (8) D	b	h	P_y = 6 kgf/cm² (8) D	b	h
25	32	25	33	100	8	28	100	12	30
32	38	31	39	120			120		33
40	45	38	46	130	9	33	130		36
50	57	49	58	140			140		
65	76	65	77	160			160		
80	89	78	90	185	11	35	185	13	37
100	108	96	110	205		37	205		38
125	133	121	135	235			235	15	40
150	159	146	161	260		38	260		43
200	219	202	222	315	13	45	315	17	50
250	273	254	278	370	16	45	370	18	
300	325	303	330	435			435		
350	377	351	382	485			485		
400	426	398	432	535			535		
500	530	501	535	640	19	50	640	19	
600	630	602	636	755		55	755		55

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Continuation Table 14.

D_y	$d_н$	d_1	$D_н$	P_y = 1; 2,5 кгс/см² (8)			P_y = 6 кгс/см² (8)		
				D	b	h	D	b	h
800	820	792	826	975	19	60	975	19	60
1000	1020	992	1028	1175	21		1175	21	
1200	1220	1192	1228	1375	23	65	1400	23	70
1400	1420	1392	1428	1575			1620	27	85
1600	1620	1592	1628	1785			—	—	—

Continuation Table 14.

D_y	$d_н$	d_1	$D_н$	P_y = 10 кгс/см² (8)			P_y = 16 кгс/см² (8)		
				D	b	h	D	b	h
10	14	8	15	90	10	33	90	12	33
15	18	12	19	95			95		
20	25	18	26	105	12	36	105		36
25	32	25	33	115		38	115		38
32	38	31	39	135	13	40	135	13	40
40	45	38	46	145		42	145		42
50	57	49	58	160			160		45

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Continuation Table 14.

D_y	$d_н$	d_1	$D_н$	$P_y = 10$ [illegible]			$P_y = 16$ [illegible]		
				D	b	h	D	b	h
[illegible]	76	66	77	180	15	46	180	18	47
[illegible]	89	78	90	195		47	195	17	50
100	108	96	110	215	17	48	215		
125	133	121	135	245	19	57	245	19	57
150	159	146	161	280			280		
200	219	202	222	335		58	335	21	58
250	273	254	278	390	21	60	405	23	65
300	325	303	330	440	22		460	24	66
350	377	351	382	500			520	28	70
400	426	398	432	565			580	32	75
500	530	501	535	670	24	65	710	38	90
600	630	602	636	780			840	41	
800	820	792	826	1010	27	75	1020	45	95
1000	1020	992	1028	1220	29	80	1255	49	110
1200	1220	1192	1228	1455	33	90	1485	51	125

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Continuation Table 14.

D_y	$d_н$	P_y = 25 кгс/см² (8): d_1	$D_н$	D	b	h	P_y = 40 кгс/см² (8): d_1	$D_н$	D	b	h
10	14	8	15	90	14	33	8	15	90	14	33
15	18	12	19	95			12	19	95		
20	25	18	26	105		34	18	26	105		34
25	32	25	33	115		36	25	33	115		36
32	38	31	39	135	16	43	31	39	135	16	43
40	45	38	46	145		45	38	46	145		45
50	57	49	58	160	17		48	58	160	17	
65	76	66	77	180	19	50	66	77	180	19	50
80	89	78	90	195		52	78	90	195	21	55
100	108	96	110	230	21	58	96	110	230	23	65
125	133	121	135	270	23	65	120	135	270	25	
150	159	146	161	300	25	68	145	161	300	27	68
[illegible]	219	202	222	360	27	75	200	222	375	35	85
[illegible]	273	254	278	425	29	75	252	278	445	39	96
[illegible]	[illegible]	303	330	485	32	80	301	330	510	42	112
[illegible]	[illegible]	361	382	550	36	85	351	[illegible]	570	48	116

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Continuation Table 14.

D_y	$d_н$	P_y = 25 кгс/см²					P_y = 40 кгс/см²				
		d_1	$D_н$	D	b	h	d_1	$D_н$	D	b	h
[illegible]	426	398	432	610	40	100	398	432	655	54	135
[illegible]	530	500	535	730	44		496	535	755	58	
[illegible]	630	600	636	840	49	118	—	—	—	—	—
[illegible]	830	790	836	1075	55	135	—	—	—	—	—

Continuation Table 14.

D_y	$d_н$	P_y = 64 кгс/см²					P_y = 100 кгс/см²				
		d_1	$D_н$	D	b	h	d_1	$D_н$	D	b	h
10	14	8	15	100	16	46	8	15	100	16	43
15	18	12	19	105			12	19	105	18	46
20	25	18	26	125	18	54	18	26	125	20	51
25	32	25	33	135	20	56	25	33	135	22	56
32	38	31	39	150	21	60	31	39	150		60
40	45	37	46	165		65	37	46	165	23	67
50	57	47	58	175	23	67	45	58	195	25	68

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Continuation Table 14.

D_y	$d_н$	$P_y = 64$ кгс/см^2 (8)					$P_y = 100$ кгс/см^2 (8)				
		d_1	$D_н$	D	b	h	d_1	$D_н$	D	b	h
65	76	64	77	200	25	72	62	77	220	29	80
80	89	77	90	210	27		75	90	230	31	87
100	108	94	110	250	29	77	92	110	265	35	97
125	133	118	135	295	33	95	112	135	310	39	112
150	159	142	161	340	35	105	136	161	350	43	125
200	219	198	222	405	41	110	190	222	430	51	140
250	273	246	278	470	45	115	236	278	500	57	160
300	325	294	330	530	50	120	284	330	585	66	180
350	377	342	382	595	56	140	332	382	655	72	196
400	426	386	432	670	62	155	376	432	715	76	200

D_y	$d_н$	$P_y = 160$ кгс/см^2 (8)					$P_y = 200$ кгс/см^2 (8)				
		d_1	$D_н$	D	b	h	d_1	$D_н$	D	b	h
15	18	12	19	105	18	50	14	23	120	24	52
[illegible]	25	18	26	125	20	56	19	29	130	26	55
[illegible]	32	25	33	135	22		26	36	180	28	60

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Continuation Table 14.

D_y	d_a	$P_y = 100$ [illegible]					$P_y = 200$ [illegible]				
		d_1	D_H	D	b	h	d_1	D_H	D	b	h
[illegible]	38	31	39	150	22	65	31	43	160	30	65
40	45	37	46	165	26	72	36	49	170	31	72
50	57	45	58	195	27	75	46	61	210	27	85
65	76	62	77	220	31	85	68	90	280	45	118
80	89	75	90	230	33	90	80	110	290	51	132
100	108	92	110	265	37	100	102	135	330	63	175
125	133	112	135	310	41	115	130	170	385	73	
150	159	136	161	350	47	130	150	196	440	79	190
200	219	190	222	430	57	145	192	248	535	89	230
250	273	236	278	500	65	165	254	330	670	107	300
300	325	284	330	585	74	185	—	—	—	—	—

Notes: 1. Coupling dies D_1, d and n - see in Table 2.

2. Nominal diameter of threads of bolts or pins - see in Table 3.

3. Sizes/dimensions: D_2 - see in Table 4; D_4 and D_5 - see in Table 5; h_2 and h_3 - see in Table 6, D_3 and D_5 - see 7; D_6; b_1 and h_4 - see 8 and 9; D_7 - see Table 10.

4. Material - see in Tables 27.

5. Flanges of carbon steel are used at temperature to 450°C, made of alloy steel - to 530°C.

Key: (1). Without projection on from 1 to 40 kg/cm². (2). From uniting by projection on from 1 to 200 kg/cm². (3). Branch. (4). With projection or depression on from 1 to 200 kg/cm². (5). With journal or slot/groove on from 1 to 100 kg/cm². (6). Under ply of oval section/cut on from 64 to 200 kg/cm². (7). Under lens ply on from 64 to 200 kg/cm². (8). kg/cm².

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Table 15. Mass of flanges without projection in kg. (GOST [All-union State Standard] 12829-67*).

D_y, мм	P_y, кгс/см² (1)					
	1; 2,5	6	10	16	25	40
10	0,27	0,33	0,48	0,57	0,68	0,68
15	0,32	0,39	0,55	0,65	0,76	0,76
20	0,43	0,51	0,83	0,93	0,99	0,95
25	0,52	0,74	1	1	1,13	1,19
32	0,73	1,06	1,47	1,47	1,76	1,76
40	0,99	1,2	1,7	1,72	2,06	2,06
50	1,14	1,39	2,1	2,12	2,66	2,69
65	1,46	1,78	2,96	2,98	3,47	3,47
80	2,26	2,59	3,41	3,95	4,18	4,54
100	2,68	2,87	4,52	4,59	6,2	6,76
125	3,38	4,32	6,43	6,36	8,87	9,56
150	3,92	5,06	7,87	7,87	11,77	12,6
200	6,41	7,84	10,57	10,68	16,68	23,7
250	9,24	10,31	13,9	16,62	23,48	36,47
300	12,29	13,73	17,47	21,41	31,73	51,04
350	14,68	16,4	22,32	30,44	44,52	67,86
400	17,04	19,03	27,32	40,94	62,33	103,5
500	24,71	24,7	36,84	67,79	85,38	129,36
600	32,91	32,91	45,34	94,27	118,42	—
800	51,34	51,36	81,05	124,65	205,77	—
1000	67,3	68,4	110,3	195,41	—	—
1200	87,43	104,1	160,4	274,3	—	—
1400	100	181,77	—	—	—	—
1600	121,13	—	—	—	—	—

Key: (1). kg/cm².

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Table 16. Mass of flanges with uniting projection in kg. (GOST 12830-67*).

D_y	P_y, кгс/см² (1)									
	1; 2,5	6	10	16	25	40	64	100	160	200
10	0,29	0,34	0,5	0,59	0,68	0,68	1,03	1,03	—	—
15	0,34	0,4	0,53	0,68	0,77	0,79	1,15	1,27	1,27	1,93
20	0,46	0,53	0,67	0,87	0,96	0,97	1,8	1,97	2,08	2,5
25	0,65	0,76	1,05	1,05	1,18	1,18	2,3	2,5	2,5	3,56
32	0,78	1,1	1,54	1,54	1,83	1,83	2,94	3,06	3,06	4,46
40	1,09	1,36	1,83	1,85	2,18	2,19	3,75	4,05	4,41	5,16
50	1,28	1,63	2,26	2,28	2,78	2,81	4,67	6,08	6,49	10,8
65	1,62	1,97	3,17	3,19	3,71	3,71	6,29	8,57	9,1	19,23
80	2,43	2,76	3,67	4,21	4,44	4,8	7,22	9,98	10,46	27,67
107	2,96	3,35	4,7	4,9	6,51	7,4	10,71	14,78	15,41	53,85
125	3,72	4,66	6,71	6,75	9,41	10	17,13	23,34	21,19	64,96
150	4,3	5,37	8,71	8,3	12,52	13,03	24,6	32,19	31,67	91,32
200	6,92	8,37	11,35	11,79	17,44	24,44	36,6	54,23	58,9	160,15
250	9,88	10,99	14,64	17,36	24,4	37,59	50,89	85,68	93,92	321,35
300	13,38	14,82	18,66	22,75	33,29	53,1	68,15	128,69	140,3	—
350	15,97	17,69	24	32,04	46,57	70,34	98,68	171,84	—	—
400	18,56	20,55	30	43	64,81	106,76	135,8	203,26	—	—
500	26,67	28,63	39,2	70,97	88,91	132,33	—	—	—	—
600	36,79	35,79	48,8	99,3	123,7	—	—	—	—	—
800	45,15	56,17	87,24	130,37	213,9	—	—	—	—	—
1000	73,44	73,51	119,19	203,39	—	—	—	—	—	—
1200	92,92	111,43	179,91	281,94	—	—	—	—	—	—
1400	101,02	156,68	—	—	—	—	—	—	—	—
1600	136,27	—	—	—	—	—	—	—	—	—

Key: (1). kg/cm².

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Table 17. Mass of male flanges or hollow in kg. (GOST 12831-67*).

D_y, mm	P_y, kgf/cm² (1) 1; 2,5 выступ (2)	1; 2,5 впадина (3)	6 выступ (2)	6 впадина (3)	10 выступ (2)	10 впадина (3)	16 выступ (2)	16 впадина (3)	25 выступ (2)	25 впадина (3)
[illegible]	[illegible]	0,27	0,31	0,32	0,5	0,48	0,6	0,58	0,69	0,66
[illegible]	[illegible]	0,12	0,4	[illegible]	0,58	0,54	0,68	0,65	0,76	0,75
[illegible]	[illegible]	0,41	0,53	0,5	0,87	0,81	0,87	0,82	0,96	0,93
25	0,53	0,5	0,77	0,72	1,06	0,98	1,06	0,99	1,18	1,13
32	0,78	0,72	1,08	1,04	1,53	1,45	1,54	1,48	1,83	1,78
40	1,04	1,02	1,37	1,28	1,78	1,71	1,81	1,77	2,11	2,1
50	1,21	1,14	1,51	1,44	2,23	2,15	2,24	2,16	2,76	2,47
65	1,57	1,46	2,06	1,83	3,11	2,92	3,17	3,05	3,62	3,6
80	2,3	2,26	2,76	2,6	3,6	3,46	4,15	4,04	4,32	4,27
100	2,7	2,65	4,04	3,03	4,7	4,49	4,8	4,65	6,58	6,27
125	3,65	3,41	4,24	3,66	6,58	6,27	6,76	6,47	9,45	9,14
150	5,22	3,96	5,85	4,93	8,2	7,77	8,28	7,88	12,56	11,9
200	6,76	6,33	9,35	7,75	11	10,47	11,72	11,28	17,21	16,86
250	9,61	9,18	10,69	10,14	14,39	10,27	15	14,3	24,08	23,27
300	13,35	12,35	14,28	14,1	19,3	17,7	22,65	20,83	32,4	31,94
350	15,93	14,9	18,65	17,64	24,7	22,56	32	29,43	45,6	44,08
400	18,53	17,3	19,69	19,3	30,35	27,65	42,64	41,1	63,58	62,41
500	26,6	25	29,1	25,9	40	37	70,32	69	88,2	86,5
600	36,7	33	36,6	33,4	50	46,6	97,81	96,73	122	106,7
800	55,5	52,2	55,2	52,2	86,1	80,4	118,79	115	211	209
10	0,69	0,66	1,02	0,98	1,02	0,99	—	—	—	—
15	0,78	0,73	1,14	1,11	1,26	1,23	1,27	1,24	1,92	1,92
20	0,99	0,91	1,81	1,76	1,98	1,9	1,98	1,94	2,54	2,53
25	1,19	1,11	2,28	2,22	2,48	2,42	2,48	2,44	3,53	3,33
32	1,85	1,76	2,94	2,88	3,05	3	3,07	3,01	4,42	4,42
40	2,16	2,	3,71	3,67	4,06	4	4,01	3,98	5,32	5,35
50	2,79	2,68	4,59	4,5	6,03	5,6	6,43	6,4	11,11	11,25
65	3,72	3,59	6,16	6,05	8,52	8,48	9,38	8,64	19,01	19,2
80	4,81	4,6	7,17	7	9,91	9,85	10,4	10,3	27,3	27,5
100	7,06	6,82	10,7	10,5	14,65	14,4	15,4	15,22	53,22	53,6
125	10,17	9,48	16,94	16,6	23,32	19,3	24,87	23,1	73,15	65,2
150	13,2	12,6	25,4	24,1	32,87	31,9	35,04	34,4	90,19	90,6
200	24	23,57	38,5	36,11	54,24	54,07	60,1	60	188,6	159
250	37,3	36,5	53,8	50,3	85,24	85,12	94,4	94,2	314,5	116,7
300	50,6	50,3	74,6	68,3	127,78	127,73	141	140	—	—
350	69,6	68	106	98,5	170,94	170	—	—	—	—
400	105,5	109	151	137	216,41	211,86	—	—	—	—
500	128	126	—	—	—	—	—	—	—	—

Key: (1). kg/cm². (2). projection. (3). hollow.

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Table 18. Mass of flanges with projection or slot/groove in kg. (GOST 12832-67*).

D_y, мм	P_y, кгс/см² (1) 1; 2,5 (2) с шипом	(3) с пазом	6 (2) с шипом	(3) с пазом	10 (2) с шипом	(3) с пазом	16 (2) с шипом	(3) с пазом
10	0,28	0,28	0,34	0,33	0,5	0,49	0,59	0,58
15	0,34	0,33	0,4	0,4	0,57	0,56	0,67	0,66
20	0,44	0,44	0,53	0,52	0,67	0,63	0,85	0,84
25	0,54	0,53	0,75	0,75	1,03	1,02	1,03	1,02
32	0,78	0,77	1,08	1,08	1,5	1,49	1,5	1,5
40	1,08	1,04	1,3	1,34	1,74	1,78	1,77	1,81
50	1,18	1,21	1,46	1,47	2,18	2,21	2,17	2,23
65	1,63	1,55	1,72	1,75	3,06	3,14	3,06	3,14
80	2,29	2,3	2,65	2,72	3,64	3,65	4,05	4,17
100	2,67	2,71	3,03	3,04	4,5	4,54	4,72	4,78
125	3,52	3,57	4,5	4,56	6,12	6,23	6,55	6,66
150	4,04	4,13	5,29	5,35	8,8	8,9	7,96	8,08
200	6,55	6,63	7,98	8,05	10,28	10,32	11,04	11,2
250	9,32	9,43	12,2	12,3	13,64	13,83	16,67	16,86
300	11,59	12,67	13,81	14,11	18,52	18,9	21,6	22,1
350	14,63	15	16,35	16,72	22,7	23	30,6	31,1
400	16,84	17,33	18,83	19,31	28	28,5	41	41,7
500	23,11	23,76	24,44	25,1	36,91	37,6	68	69,9
600	32,9	33,37	37,49	33,67	45,52	48,7	94,5	96,6
700	40,34	41,6	40,6	41,86	59,86	62,28	100,7	101,1
800	51,49	52,6	51,67	52,36	61,26	64,28	124,8	127,6
10	0,68	0,67	0,68	0,66	0,99	0,99	1,01	1,02
15	0,76	0,76	0,8	0,78	1,12	1,13	1,24	1,25
20	0,97	0,95	0,97	0,95	1,78	1,8	1,95	1,95
25	1,16	1,15	1,16	1,15	2,26	2,27	2,45	2,46
32	1,81	1,8	1,7	1,69	2,91	2,92	3,03	3,03
40	2,08	2,11	2,11	2,15	3,67	3,74	4	4,07
50	2,69	2,75	2,72	2,78	4,61	4,6	5,94	6,05
65	3,55	3,62	3,6	3,68	6,06	6,19	8,41	8,84
80	4,26	4,48	4,69	4,8	7,06	7,18	9,77	9,96
100	6,41	6,49	7,2	7,28	10,88	10,67	14,47	14,66
125	9,27	9,37	9,97	10,08	16,66	16,91	23	23,3
150	12,01	12,17	12,86	13,03	24,06	24,44	31,73	32,22
200	16,36	16,62	24,2	24	35,74	36,27	51,14	53,9
250	25,37	25,74	36,9	37,4	49,45	50,16	83,37	84,51
300	32,42	33,16	51,1	52,2	65,04	62,52	125,24	127,41
350	45,4	46,23	68,1	68,8	94,71	96,27	167,22	169,58
400	63,46	64,59	103,8	106	128,9	130,87	207,25	210,24
500	86,48	88,08	128	130	—	—	—	—
600	119,5	122,17	—	—	—	—	—	—
800	210	214,68	—	—	—	—	—	—

Key: (1). kg/cm². (2). with journal. (3). with slot/groove.

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Table 19. Mass of flanges under the ply of oval section/cut (GOST 12833-67*) and under lens ply in kg. (GOST 12835-67*).

D_y, мм	(1) Под прокладку овального сечения				(2) Под линзовую прокладку			
	P_y, кгс/см² (3)							
	64	100	160	200	64	100	160	200
10	0,99	0,99	—	—	1,03	1,03	—	—
15	1,11	1,23	1,23	1,88	1,15	1,27	1,27	1,93
20	1,75	2,02	2,03	2,46	1,8	1,97	2,08	2,5
25	2,25	2,45	2,44	3,5	2,3	2,5	2,5	3,59
32	2,87	2,99	2,98	4,35	2,94	3,05	3,06	4,43
40	3,67	3,95	3,97	5,27	3,75	4,06	4,06	5,46
50	4,5	5,95	6,3	9,86	4,63	6,08	6,49	10,06
65	6,09	8,4	8,88	18,97	6,26	8,57	9,1	19,23
80	6,87	9,8	10,2	27,23	7,05	9,98	10,46	27,55
100	10,48	14,44	15,09	53,26	10,71	14,67	15,41	53,61
125	16,67	23,04	23,82	65,37	16,98	23,34	24,19	64,74
150	24,18	31,87	33,92	90,02	24,6	32,19	34,48	90,92
200	36,03	53,81	57,86	158,63	36,45	61,23	68,9	159,69
250	50,08	85,4	92,16	—	50,58	85,26	93,11	—
300	67	127,76	136,56	—	67,59	128,35	139,2	—
350	96,42	169,55	—	—	97,08	171,6	—	—
400	134,93	211,1	—	—	135,7	212,9	—	—

Key: (1). Under the ply of oval section/cut. (2). under lens ply. (3). kg/cm².

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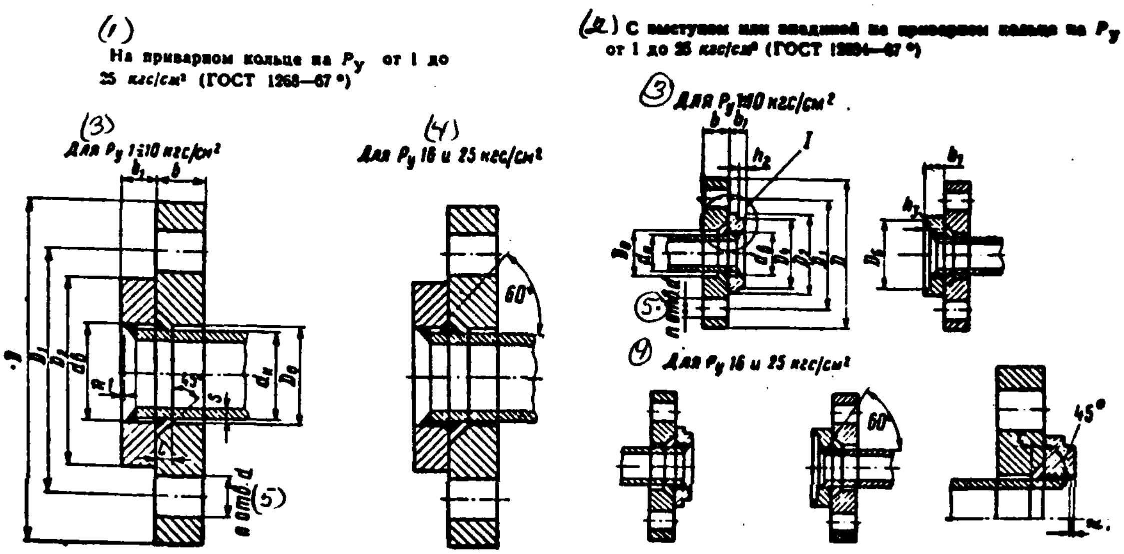
Table 20. Flanges steel free.



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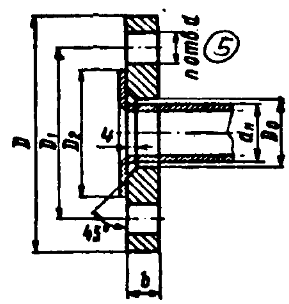
Continuation Table 20.

(6) На отбортованной трубе на P_y=1; 2,5 и 6 $кгс/см^2$ (ГОСТ 1272—67)



D_y	(7) Размеры в мм				D_y	(7) Размеры в мм			
	$d_н$	$d_в$	D_0	c		$d_н$	$d_в$	D_0	c
10	14	15	16	4	100	108	110	112	6
15	18	19	20		125	133	135	138	
[illegible]	25	26	27		150	159	161	164	

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Continuation Table 20.

D_y	Размеры в мм								
	$d_н$	$d_в$	D_6	c	D_y	$d_н$	$d_в$	D_6	c
25	32	33	34		200	219	222	225	8
32	38	39	41		250	273	273	279	11
40	45	46	48	5	300	325	325	331	
50	57	59	61		350	377	377	383	
65	76	78	80		400	426	426	433	12
80	89	91	93	6	500	530	530	537	

Notes: 1. Coupling dies D_1, d and n - see in Table 2.

2. Nominal thread diameter of bolts or pins - see in Table 3.

3. Sizes/dimensions: D_2 - see in Table 4; D_4 and D_6 - see in Table 5; h_2 and h_3 - see in Table 6; b and b_1 - see in Table 21.

4. Size/dimension of perpendicular of weld and wall thickness of duct must be determined by projecting/designing organization during strenth calculation.

5. Material - see in Table 27.

6. Mass of flanges approximately corresponds to mass of flanges of flat/plane welded ones without projection according to GOST 12827-67* (see Table 12).

Key: (1). On welded ring on from 1 to 25 kg/cm² (GOST 1268-67*). (2). With projection or hollow on welded ring on from 1 to 25 kg/cm² (GOST 12834-67*). (3). For kg/cm². (4). For 16 and 25 kg/cm². (5). Branch. (6). On flanged duct to 2.5 and 6 kg/cm² GOST 1272-67). (7). Sizes/dimensions in mm.

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Table 21.

Thickness of flanges and welded rings in mm (GOST 1268-67*, 12834-67* and 1272-67).

D_y, мм	P_y, кгс/см² (1)							
	1; 2,5; 6		10		16		25	
	s	s_1	s	s_1	s	s_1	s	s_1
10	10	8	12	10	14	12	16	14
15								
20								
25	12	10	14	12	16	14	18	16
32			16		18	16	20	
40								
50		12	18	14	20		22	18
65	14	14	20	16	22	18	24	20
80			22		24		26	
100			24		26	20	28	22
125								
150	16	16	26	18	28	22	30	24
200	18	18		20				
250	20		28	22	30	34	32	26
300	24	20	30	22	32	34	34	28
350	28		32	24	34	36	36	28
400	32	24	34	26	36	38	42	30
500	36	26	38	28	42	30	50	32

Key: (1). kg/cm².

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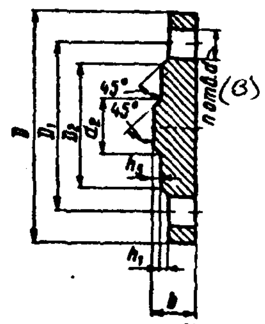
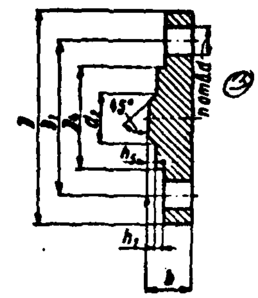
§2. Plugs are flanged.

Table 22.

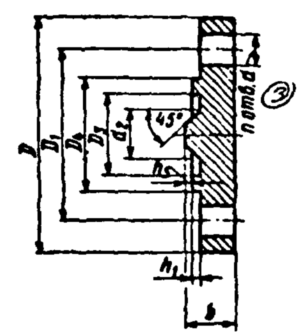
(1) С соединительным выступом на P_y от 1 до 40 кгс/см² (ГОСТ 12836—67 *)



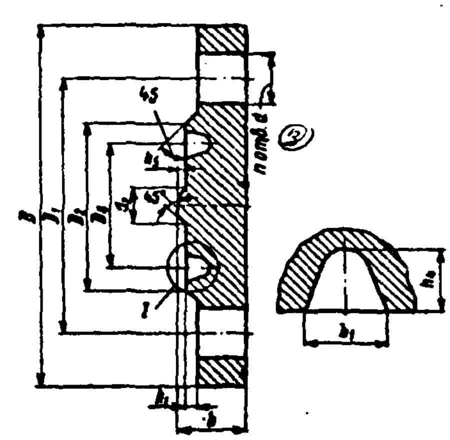
(2) С выступом на P_y от 40 до 200 кгс/см² (ГОСТ 12837—67 *)



(4) С шипом на P_y от 1 до 40 кгс/см² (ГОСТ 12836—67 *)



(5) Под прокладку овального сечения на P_y 64 и 100 кгс/см² (ГОСТ 12839—67 *)



D_y, мм	(7) 1 и 2,5	6	10	16	25	40	64	100	160	200	d_0
	(6) Толщина заглушки b в мм на P_y, кгс/см²										
10							18; 22	18; 25	—	—	6
15	10	12	12	12	12	16		20; 25	24	26	10
20							20; 22	22; 25	28	28	16

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Continuation Table 22.

D_y мм	Толщина заглушки b в мм на P_y, кгс/см²										4
	1 и 2,5	6	10	16	25	40	64	100	160	200	
25	10	12	12	12	12	16	22; 25	24; 25	28	30	28
32									30	32	30
40	12	14	14	14	14		24; 25	26; 28	32	34	36
50						18	26; 30	28, 32	38	40	46
65					16	20	28; 32	32; 36	45	46	60
80					18	22	30; 36	34; 40	48	52	76
100				16	20	24	32; 36	38; 45	50	63	94
125	14	16	16		22	28	36; 40	45; 50	60	70	118
150				18	24	30	40; 45	52; 56	70	85	142
200				20	26	38	50; 56	58; 63	80	95	196
250			18	24	30	45	58; 63	65; 70	90	120	244
300	16	18	20	28	34	48	63; 65	80; 85	100	—	294
350			24	32	38	50	63; 70	85; 95	—	—	344
400	18	20	26	34	40	56	70; 75	90; 96	—	—	390
500	20	24	30	40	48	70	—	—	—	—	490

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Continuation table 22.

D_y, мм	Толщина заглушки b в мм на P_y, кгс/см²										(4)
	1 и 2,5	6	10	16	25	40	64	100	160	200	
600	24	28	34	45	50	—	—	—	—	—	590
800	30	34	42	52	63	—	—	—	—	—	780
1000	34	45	50	63	—	—	—	—	—	—	980
1200	36	45	55	75	—	—	—	—	—	—	1180
1400	38	50	—	—	—	—	—	—	—	—	1380
1600	40	—	—	—	—	—	—	—	—	—	[illegible]

Notes: 1. For P_y 64 and 100 kg/cm² the first value of size/dimension of b corresponds to silencers/plugs with projection (GOST 12837-67*), the second value - to silencers/plugs under the ply of oval section/cut (GOST 12839-67).

2. Coupling dies D, D_1, d and n - see in Table 2.

3. Nominal thread diameter of bolts or pins - see in Table 3.

4. Sizes/dimensions: D_2 - see in Table 4; D_4 - see in Table 5;

h_1 - see in Table 6; D_3 - see table 7; D_6, b_1 and h_4 - see in tables 8 and 9.

5. Size/dimension h_5 for D_y = 10 ÷ [illegible] − [illegible] mm; for D_y = [illegible] for D_y = [illegible] ÷ 1000 − 4 mm.

6. Material - see in Table 27.

7. Plugs of carbon steel are used at temperature to 450°C, made of alloy steel - to 530°C.

Key: (1). With uniting projection on from 1 to 40 kg/cm² (GOST 12836-67*). (2). With projection on from 40 to 200 kg/cm² (GOST 12837-67*). (3). Branch. (4). With journal on from 1 to 40 kg/cm² (GOST 12838-67*). (5). Under ply of oval section/cut on 64 and 100 kg/cm² (GOST 12839-67*). (6). Thickness of silencer/plug b in mm on kg/cm². (7). and.

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Table 23. Mass of silencers/plugs with uniting projection in kg. (GOST 12836-67*).

D_y, mm	P_y, kg/cm² (1) 1; 2,5	6	10	16	25	40
10	0,2	0,26	0,38	0,38	0,38	0,56
15	0,24	0,31	0,43	0,43	0,43	0,63
20	0,31	0,4	0,55	0,55	0,55	0,8
25	0,4	0,51	0,67	0,67	0,67	0,98
32	0,57	0,74	0,91	0,91	0,91	1,33
40	0,82	1,02	1,24	1,24	1,24	1,43
50	0,98	1,21	1,55	1,55	1,55	2,15
65	1,23	1,54	2,04	2,04	2,29	3,03
80	1,78	2,18	2,44	2,44	3,21	4,08
100	2,25	2,75	2,97	3,51	5,07	6,27
125	3,65	4,3	4,69	4,69	7,83	10,31
150	4,58	5,38	6,07	6,99	10,95	14,07
200	7,03	8,22	9,09	11,49	17,51	28,3
250	9,87	11,51	14,26	19,74	28,93	48,5
300	14,93	17,18	19,86	29,58	42	66,99
350	19,02	21,84	31,94	44,22	61,48	88,9
400	26,85	30,28	44,43	59,86	81,12	131,59
500	44,44	54,33	74,31	102,69	140,22	218,77
600	73,46	87,2	119,27	161,98	194,5	—
800	158,74	181,65	242,06	300,6	409,07	—
1000	269,07	360,91	429,64	542,16	—	—
1200	394,11	512,66	673,13	922,18	—	—
1400	551,94	769,59	—	—	—	—
1600	780,8	—	—	—	—	—

Key: (1). kg/cm².

Table 24. Mass of silencers/plugs with projection in kg. (GOST 12837-67*).

D_y, mm	P_y, kg/cm² (1) 40	64	100	160	200
10	0,48	0,71	0,71	—	—
15	0,55	0,77	0,92	1,18	1,47
20	0,7	1,3	1,48	1,83	1,96
25	0,86	1,76	1,86	2,28	2,89
32	1,16	2,12	2,37	3,13	3,74
40	1,37	2,94	3,25	4,18	4,43
50	2,01	3,73	4,97	7,14	8,13
65	2,91	5,19	7,16	10,58	15,6
80	3,83	6,32	8,55	12,61	21,39
100	6,03	9,74	13,09	17,75	40,4
125	10,02	15,69	21,93	30,02	50,55
150	13,71	23,4	32,29	44,44	81,44
200	27,73	43	55,34	77,82	138,82
[illegible]	[illegible]	67,7	87,07	122,87	277,2
[illegible]	[illegible]	91,7	141,21	179,24	—
[illegible]	[illegible]	119	[illegible]	—	—
[illegible]	[illegible]	[illegible]	[illegible]	—	—
[illegible]	[illegible]	—	—	—	—

Key: (1). kg/cm².

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Table 25. Mass of silencers/plugs with journal in kg. (GOST 12838-67*).

D_y, мм	P_y, кгс/см² (1)					
	1; 2,5	6	10	16	25	40
10	0,14	0,2	0,29	0,29	0,29	0,47
15	0,16	0,23	0,33	0,33	0,33	0,53
20	0,21	0,3	0,41	0,41	0,41	0,67
25	0,26	0,38	0,5	0,5	0,5	0,84
32	0,38	0,55	0,68	0,68	0,79	1,1
40	0,68	0,88	1,06	1,06	1,06	1,3
50	0,82	1,04	1,31	1,31	1,31	1,91
65	1,12	1,41	1,73	1,73	2,1	2,77
80	1,49	1,88	2,07	2,07	2,88	3,75
100	1,93	2,42	2,58	3,18	4,62	5,82
125	3,28	3,86	4,17	4,17	5,73	9,72
150	4,13	4,87	5,44	6,36	10,21	13,33
200	6,4	7,53	8,23	10,72	16,48	27,19
250	9,23	10,57	13,17	19,62	27,52	46,87
300	13,48	16,18	18,32	29,48	39,87	64,33
350	17,35	19,88	30,05	44,5	58,95	85,84
400	21,45	28,87	42,07	59,55	77,91	129,32
500	31,92	51,74	71,28	107,52	135,91	214,05

Key: (1). kg/cm².

Table 26. Mass of silencers/plugs under the ply of oval section/cut in kg. (GOST 12839-67*).

Table 26.

D_y, мм	P_y, кгс/см² (1)		D_y, мм	P_y, кгс/см² (1)	
	64	100		64	100
10	1,04	1,21	125	17,94	25,05
15	1,16	1,35	160	27,47	36,4
20	1,63	1,89			
25	2,3	2,25	200	49,32	61,38
32	2,7	2,7			
40	3,3	5,57	250	74,86	96,64
50	4,55	6,03	300	96,7	152,4
65	6,21	8,45	350	134,8	2[illegible]3,9
80	7,95	10,53	400	179	[illegible]0,44
100	11,32	16,07	—	—	

Key: (1). kg/cm².

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§3. Materials for manufacturing of flanges, silencers/plugs and fasteners.

Table 27. Materials for manufacturing of flanges and silencers/plugs on P_y to 200 kg/cm².

(1) Тип фланца, заглушки и номер ГОСТа	P_y, кгс/см² (2)	(3) Марка стали при температуре среды в °С		
		(4) до 300	(5) свыше 300 до 450	(5) свыше 450 до 530
(6) IV. Стальные с шейкой на резьбе по ГОСТ 12826—67 и 1245—67	(7) От 1 до 16	(8) ВСт. 3сп	(9) Не применяют	
(10) V. Стальные плоские приварные по ГОСТ 12827—67 *, 1255—67 * и 12828—67 *	(7) От 1 до 25	(8) ВСт. 3сп	(11) То же	
(12) VI. Стальные приварные встык по ГОСТ 12829—67 *, 12830—67 *, 12831—67 *, 12832—67 *, 12833—67 *, 12835—67 *	(7) От 1 до 25	(8) ВСт. 3сп	(13) 20 и 25	(9) Не применяют
	(5) От 40 до 200	20 и 25 (13)		15ХМ и 15ХМА
(14) VII. Стальные свободные на приварном кольце по ГОСТ 1268—67 * и 12834—67 *	(7) От 1 до 25	(15) Ст. 4сп и Ст. 5сп	(9) Не применяют	
(16) VIII. Стальные свободные на отбортованной трубе по ГОСТ 1272—67	(7) От 1 до 6	(15) Ст. 4сп и Ст. 5сп	(11) То же	
(17) Заглушки фланцевые: по ГОСТ 12836—67 *, 12837—67 *	(7) От 1 до 25	(8) ВСт.3сп	20 и 25 (13)	(9) Не применяют
(18) по ГОСТ 12838—67 * и [illegible] 67 *	(5) От 40 до 200	(13) 20 и 25		(13) 15ХМ и 15ХМА

Notes: 1. Weld rings for slip-on flanges [illegible] of steel of the brand/mark VSt.3sp.

2. Brands of steels VSt.3sp, St.4sp and St.5sp - according to GOST 380-71; 20 and 25 - per GOST 1050-60; 15 Khm and 15 KhMA - according to GOST 4543-71.

Key: (1). Type of flange, silencer/plug and number of Gost. (2). kg/cm². (3). Trademark of steel at temperature of medium in °C. (4). to. (5). it is more than 300 to 450. (6). Steel with neck on thread according to GOST 12826-67 and 1245-67. (7). From 1 to 16. (8). VSt.3sp. (9). They do not use. (10). Steel flat/plane welded according to GOST 12827-67*, 1255-67*, and 12828-67*. (11). The same. (12). Steel welded butt according to GOST 12829-67*, 12830-67*, 12831-67*, 12832-67*, 12833-67*, 12836-67*. (13). and. (14). Steel free on welded ring according to GOST 1268-67* and 12834-67*. (15). St.4sp and St.5sp. (16). Steel free on flanged duct according to GOST 1272-67. (17). Silencers/plugs flanged: according to GOST 12836-67*, 12837-67*. (18). according to GOST 12838-67* and.

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Table 28. Materials for manufacturing the fasteners for flange joints on P_y to 200 kg/cm².

(1) Наименование деталей	(2) P_y, кгс/см²	(3) Марки стали при температуре среды в °С, до				
		300	350	425	450	530
(4) Болты (или шпильки)	2,5—25	(5) 20 и 25		(5) 25 и 35	30ХМА	—
(6) Шпильки	40—100	35			30ХМА, 35ХМА	25Х1МФ
	160; 200	35	35Х			
(7) Гайки	2,5—25	10 и 20		(5) 20 и 25		—
	40—100	25				30ХМА, 35ХМА
	160; 200	25	35		35Х	
(8) Шайбы	40—200	(5) 10 и 20				15ХМ

Note. Trademarks of steel: 10, 20, 25 and 35 - according to GOST 1050-60**, 15KhM, 15KhMA, 35Kh, 30KhMA and 35KhMA - according to GOST 4543-71, 25Kh1MF - according to

Key: (1). Designation of parts. (2). kg/cm². (3). Trademarks of steel at temperature of medium in °C, to. (4). Bolts (or pins). (5). and. (6). Pins. (7). Nuts. (8). Disks.

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Chapter V.

COMPENSATORS.

§1. General information.

With the transporting of different products with the increased or reduced temperatures occur changes in the lengths of conduits/manifolds.

With the affixing of such conduits/manifolds by rigid (fixed) supports in ducts appear the stresses/voltages also in the case of the absence of the devices, which compensate for (absorbing) changes in the lengths of conduits/manifolds, can occur the deformations of ducts or the decomposition of supports.

Thermal changes in the lengths of conduits/manifolds at temperature of medium not more than 80°C can be compensated by the elasticity of conduit/manifold itself when in it of offtakes, its small extent and correct arrangement of supports is present.

Such an autocompensation is the best method of the compensation for thermal changes in the lengths of conduits/manifolds (Fig. 1).

However, in the majority of the cases on conduits/manifolds install compensators, since depending on temperature variations occurs a significant change in the lengths of conduits/manifolds.

A change in the length of conduit/manifold depends on its reference length, greatest temperature drop and coefficient of the thermal linear expansion of the material of conduit/manifold and is determined from the formula

$$\Delta l = L_0 \alpha t \ мм, \qquad (1)$$

where L_0 - the reference length of the conduit/manifold between fixed supports m;

α - coefficient of the linear expansion of the material 1 m of duct in mm/m•deg.

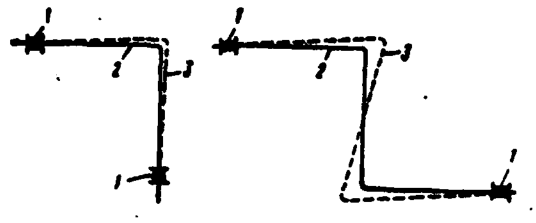

Fig. 1. Schematic of autocompensation of conduit/manifold. 1 - rigid fixed supports; 2 - arrangement of the cold duct; 3 - arrangement of hot duct.

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t - temperature drop between the calculated temperature of heat carrier (medium) and the calculated temperature of surrounding air in deg.

The values of coefficients for low-carbon steel depending on the temperature of the wall of duct are given in Table 1.

Fig. 2 gives the nomogram of the temperature elongation of ducts made of low-carbon steel in dependence on their length and value of temperature drop.

On nomogram in the form of example it is shown that with

temperature drop in 230° and at length of conduit/manifold 40 m the elongation of conduit/manifold is 120 mm.

According to structural/design forms and operating principle the compensators divide into the following groups:

a) the pliable radial, receiving thermal elongations because of the elastic bending strain of the sections of the ducts of different geometric form;

b) pliable (elastic) of the axial type, in which changes of the length of ducts are absorbed by the special springy elements/cells, which have the form of lens, waves and which are deformed in the axial direction;

c) slipping type axial, in which thermal elongations are extinguished by the moving in of ducts inside the housing of the compensator through stuffing-boxs seal.

The types of compensators on conduits/manifolds determines planning organization.

Table 1. Coefficient of linear expansion for pipe steels of brands 10, 15, 20, St.2, St.3, St.4.

(1) Температура стенки трубы в °C	(2) Коэффициент линейного расширения в мм/м·град	(1) Температура стенки трубы в °C	(2) Коэффициент линейного расширения в мм/м·град
20	$1,18 \cdot 10^{-2}$	250	$1,31 \cdot 10^{-2}$
75	$1,2 \cdot 10^{-2}$	275	$1,32 \cdot 10^{-2}$
100	$1,22 \cdot 10^{-2}$	300	$1,34 \cdot 10^{-2}$
125	$1,24 \cdot 10^{-2}$	325	$1 \cdot 35 \cdot 10^{-2}$
150	$1,25 \cdot 10^{-2}$	350	$1,36 \cdot 10^{-2}$
175	$1,27 \cdot 10^{-2}$	375	$1,37 \cdot 10^{-2}$
200	$1,28 \cdot 10^{-2}$	400	$1,38 \cdot 10^{-2}$
225	$1,30 \cdot 10^{-2}$	425	$1,40 \cdot 10^{-2}$

Note. Table gives the average coefficient of linear expansion α during heating from 0 to t°C.

Key: (1). Temperature of the wall of duct in °C. (2). Coefficient of linear expansion in mm/m•deg.

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§2. Pliable radial compensators.

Pliable radial compensators are prepared U-shaped, S-shaped, U-shaped and ringlike.

For technological conduits/manifolds from this group

predominantly are used the U-shaped compensators, prepared from internal ducts or welded ones with the use/application of sharply bent or welded offtakes (Fig. 3).

The bent compensators are prepared from the smooth seamless pipes of the same trademarks of steels, that also basic conduit/manifold, and allow/assume in installation without lowering in the basic parameters the work of entire conduit/manifold.

Welded compensators with sharply bent offtakes establish/install in conduits/manifolds from P_y to 100 kg/cm², but with welded ones - with P_y not above 64 kg/cm².

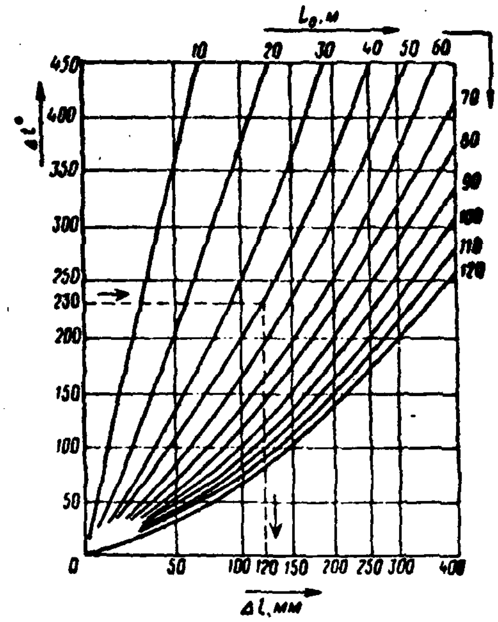

Fig. 2. Nomogram of the thermal elongation of conduit/manifold made of low-carbon steel. Δt - temperature drop in deg; L_0 - length of conduit/manifold m; Δl - elongation of conduit/manifold in mm.

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The schematic diagram of the work of U-shaped compensator is shown in Fig. 4.

U-shaped compensators distinguish (see Fig. 3) on relationship/ratio the lengths of the straight/direct insert- back P and the length of the straight line of insert-escape h. With the large escape P=0.5h, with the average P=h and with the the small P=2h. The greatest compensation capacity possess compensators with large escape.

The calculation of conduits/manifolds for compensation, determination of the appearing stresses/voltages in conduit/manifold with temperature changes and structural/design sizes/dimensions of compensators composes planning organization.

Basic technical specifications and sizes/dimensions during the manufacture of U-shaped compensators by those bent from ducts, from sharply bent and welded offtakes following.

The radii of the bent offtakes from ducts usually receive equal ones to $3-4D_y$, for sharply bent ones - 1- $1.5D_y$ according to GOST 17375-72 and for welded ones - $1-1.5D_y$ according to MN 2880-62.

The welds of the separate elements/cells of U-shaped compensators must be in the straight/direct sections of conduits/manifolds at a distance from the beginning of the curvature of offtakes (besides the cases of applying the sharply bent offtakes), equal to the outside diameter of duct, but it is not less than 100 mm for ducts $D_y<150$ of less than 200 mm for ducts $D_y \geq 150$ it is less more.

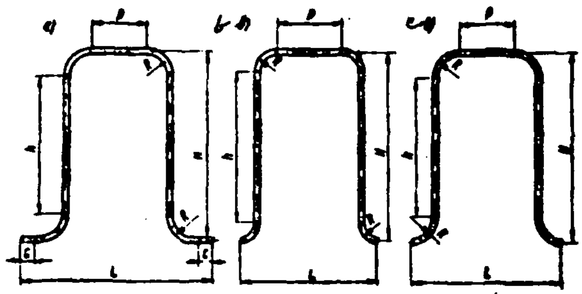

Fig. 3. U-shaped compensators. a) bent; b) by the welded sharply bent offtakes; c) with welded offtakes.

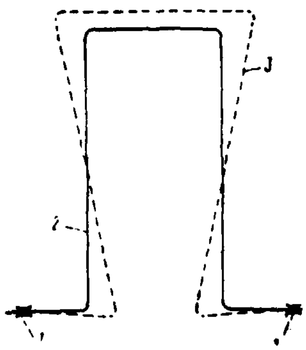

Fig. 4. Diagram of work of U-shaped compensator. 1 - fixed supports; 2 - compensator in the cold state; 3 - compensator in the heated state.

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For the compensators, bent from the ducts (see Fig. 3a):

$$\left.\begin{aligned} h &= H - 2R \quad (1) \\ L &= p + 4R + 2c, \end{aligned}\right\} \quad (2)$$

Key (1) and.

where c=100 mm for ducts $D_y < 150$ mm and 200 mm for ducts $D_y = 150$ mm and more.

Expanded/scanned length of the blank

$$l = 2c + 2\pi R + p + 2h. \quad (2a)$$

For compensators with the welded sharply bent and welded offtakes (see Fig. 3b, c)

$$\left. \begin{aligned} h &= H - 2R \text{ и}^{(1)} \\ L &= p + 4R. \end{aligned} \right\} \quad (3)$$

Key: (1). and.

The most strained section in U-shaped compensator is the middle of the straight/direct part of the back (p), to the form of what weld in this place is not allowed/assumed.

U-shaped compensators from the bent ducts, sharply bent offtakes and welded offtakes are not standardized. During their planning and manufacture they are guided by GOST 9842-61, GOST 17375-72, standards of machine-building MN 2912-62, of MN 2880-62 and by other interdepartmental standards.

§3. Axial type pliable (elastic) compensators.

1. The expansion bellows.

The expansion bellows are intended for installation on conduits/manifolds in diameters from 100 to 2400 mm, which transport nonagressive or slightly agressive products at a pressure to 6

kg/cm^2.

Compensators on $P_y=6$ kg/cm^2 is allowed/assumed to use for an operating pressure to 7 kg/cm^2 at temperature of product not more than 200°C.

The compensation capacity of one lens depends on its diameter and thickness of wall (Table 2).

Depending on the necessary compensation capacity are used mono-, bi, ter- and four-lens compensators.

For decreasing the resistance to motion of product within compensators usually are established/installed the sleeves/beakers; for the chute of condensate in the lower places of each lens are welded in drain pipes.

Compensators to conduits/manifolds add on weld or with the aid of flanges.

Type and the sizes/dimensions of the expansion bellows made of carbon steel are standardized and are prepared on MN 2894-62 - MN 2908-62.

Table 3-6 reduced mass and sizes/dimensions of mono-, two-, ter- and tetra-lens compensators.

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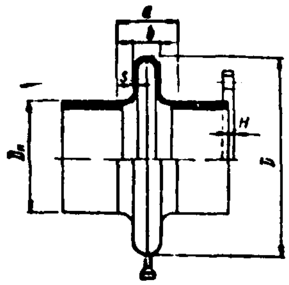
Table 2. Sizes/dimensions and compensation capacity of one lens in mm (MN 2894-32 and MN 2896-62.



D_y	$D_н$	D		a		b		S					[1] Полная компенсирующая способность одной линзы, Δ					H [2] Недовод.
		P_y [3] кгс/см²																
		0,2—1	2,5—6	0,2—1	2,5—6	0,2—1	2,5—6	0,2	1	2,5	4	6	0,2	1	2,5	4	6	
100	108	420	300	120		64							48	48	15	16	9,5	6
125	133	470	330										49	49	15	15	9,5	
150	159	520	360										51	51	16	16	9,5	
175	194	550	390		100	72	54	2,5	2,5	2,5	2,5	3,5	50	49	14	14	9	7
200	219	580	420										50	49	14	15	9	8
250	273	620	480	140									44	43	14	14	9	10
300	325	670	550								3	4	42	41	16	14	9	
[illegible]	[illegible]	750	620										40	39	16	14	8,5	
[illegible]	[illegible]	830	670						3	3	3,5	5	37	46	16	14	8,5	11
450	478	880	720						3	3	3,5	5	55	46	16	13,5	8	
500	529	930	770	140		72		2,5					54	44	15	13	8	
600	630	1030	870										52	42	14	12,5	8	
700	720	1120	960	160	100	82	54						51	41	14	12	7,5	11
800	820	1220	1060								—	—	51	41	13,5	—	—	
900	920	1320	1160								—	—	42	41	12,5	—	—	
1000	1020	1420	1260						3,5		—	—	41	40	12,5	—	—	
1200	1220	1620	—	180	—	92	—			—	—	—	40	39	—	—	—	12
1400	1420	1820	—		—		—			—	—	—	39	—	—	—	—	13
1500	1520	1920	—		—	102	—	3	—	—	—	—	38	—	—	—	—	
1600	1620	2020	—	200	—		—		—	—	—	—	38	—	—	—	—	
1800	1820	2220	—		—		—		—	—	—	—	37	—	—	—	—	14
2000	2020	2420	—		—		—		—	—	—	—	36	—	—	—	—	
2200	2220	2620	—	240	—	122	—		—	—	—	—	34	—	—	—	—	
2400	2420	2820	—		—		—		—	—	—	—	32	—	—	—	—	

Notes: 1. Sizes/dimensions D, a, b, S and value of compensation capacity are related to the expansion bellows of all types.

2. Full/total/complete compensation capacity of compensator (in mm) define as result of product values compensation capacities one lens, for number of lens of compensator.

3. Value of compensation capacity is shown for compensators, established/installed in conduits/manifolds with temperature of product not more than 100°C. At higher temperature the value of compensation capacity is lowered: with t from 100 200°C - to 5o/o; with t more than 200 to 300°C - to 10o/o; with t more than 300 to 450°C - to 15o/o.

Key: (1). Full/total/complete compensation capacity of one lens. (2). deficit. (3). kg/cm².

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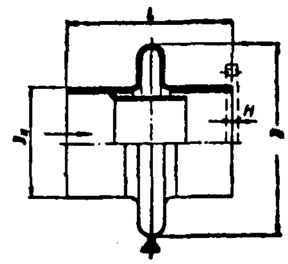
1. Single-lens compensators.



(1) Тип I — со стаканом (МН 2894-62)
(2) Тип II — без стакана (МН 2895-62)

Key: (1). Type I - with sleeve/beaker (MN 2894-62). (2). Type II - without sleeve/beaker (MN 2895-62).

Table 3. Sizes/dimensions in mm and mass in kg. of single-lens compensators (without flanges).

D_y	$D_н$	P_y (1) кгс/см², 0,2: L	0,2: (2) масса (3) без стакана	0,2: (4) со стаканом	1: L	1: без стакана	1: со стаканом	2,5: L	2,5: без стакана	2,5: со стаканом	4: L	4: без стакана	4: со стаканом	6: L	6: без стакана	6: со стаканом
100	108	425	11,3	12,3	425	11,3	12,3	405	8,2	8,9	405	8,2	8,9	445	10	10,7
125	133		13,9	15,1		13,9	15,1		9,9	10,8		9,9	10,8	485	12,8	13,7
150	159		16,8	18,2		16,8	18,2	445	12,6	13,6	445	12,6	13,6		16,9	17,9
175	194	445	19,3	21,1	445	19,3	21,1		14,9	16,2		14,9	16,2	545	19,4	20,7
200	219		21,1	23,2		21,1	23,2	545	19,9	21,3	545	19,9	21,3	675	25,9	27,3
250	273		26,7	29,2		26,7	29,2		27,6	29,2		28,8	30,7		27,2	30,1
300	325		34,3	37,4		34,3	37,4		36,8	39		38,6	40		40,5	51,7
350	377		42,9	46,5		46,2	49,8		49,4	51,9		51,5	54		67	60,6
400	426	445	49,9	54	445	53,8	57,8	605	60,5	63,4	605	63	65,9	675	75,4	79,3
450	478		55,4	60		59,7	64,3		67,9	71,3		70,8	74		94,8	94,1
500	529		60,5	68,2		65,1	72,8	675	83,1	88,5	675	86,6	91	735	99,7	105,2
600	630		71	80,2		76,3	85,5	735	106,8	113,3	735	109,8	116,3		117,4	123,9
700	720		79	92,1		85,4	98,5		121,7	129,1		125,1	132,6		133,8	141,2
800	820	465	89,8	104,8	465	96,3	111,3		128,1	136,6	—	—	—	—	—	—
900	920		106,5	123,3		113,4	130,3	675	143,6	153,3	—	—	—	—	—	—

Continuation Table 3.

1000	1020		118,3	139,2	485	126	146,9	675	158,5	169,5	—	—	—	—	—	—
1200	1220	485	149,7	191		158,7	200,1	—	—	—	—	—	—	—	—	—
1400	1420		173,6	222,1	—	—	—	—	—	—	—	—	—	—	—	—
1500	1520		187,3	242,9	—	—	—	—	—	—	—	—	—	—	—	—
1600	1620	505	200,4	259,7	—	—	—	—	—	—	—	—	—	—	—	—
1800	1820		223	289,8	—	—	—	—	—	—	—	—	—	—	—	—
[illegible]	2020		247,1	326,3	—	—	—	—	—	—	—	—	—	—	—	—
[illegible]	2220	545	308,1	394,7	—	—	—	—	—	—	—	—	—	—	—	—
[illegible]	2420		335,5	430,2	—	—	—	—	—	—	—	—	—	—	—	—

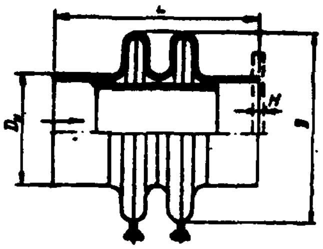
Notes: 1. Sizes/dimensions D and H are given in Table 2.

2. Other notes see in tables 6.

Key: (1). kg/cm². (2). mass. (3). without sleeve/beaker. (4). with sleeve/beaker.

Pages 167-169.

2. Two-lens compensators.



Key: (1). Type I - with sleeve/beaker (MN 2894-62). (2). Type II - without sleeve/beaker (MN 2895-62).

Table 4. Sizes/dimensions in mm and mass in kg. of two-lens compensators (without flanges).

D_y	$D_н$	P_y, кгс/см² (1): 0,2			1			2,5			4			6		
		L	(2) масса		L	(2) масса		L	(2) масса		L	(2) масса		L	(2) масса	
			(3) без стакана	(4) со стаканом		(3) без стакана	(4) со стаканом		(3) без стакана	(4) со стаканом		(3) без стакана	(4) со стаканом		(3) без стакана	(4) со стаканом
100	108	545	17,8	19,5	545	17,8	19,5	505	11,6	12,8	505	11,6	12,8	545	14,7	15,9
125	133		21,7	23,9		21,7	23,9		13,8	15,3		13,8	15,3	585	18,1	19,6
150	159		26,3	28,9		26,3	28,9		17	18,8		17	18,8		23,1	24,8
175	194	585	29,6	33	585	29,6	33	545	19,6	22,1	545	19,6	22,1	645	26,3	28,5
200	219		32,3	36		32,3	36		25,4	29,9		25,4	29,9		33,3	35,8
250	273		38,8	43,5		38,8	43,5		34,3	37,4		36,7	39,9		47,7	50,8
300	325		47,9	53,5		47,9	53,5	645	44,9	48,7	645	48,4	52,2	775	52,4	66,1
350	377		59,1	65,7		65,8	72,4		61,1	65,6		65,3	69,7		88,3	90,8
400	426	585	69,2	76,7	585	77	84,5		73,2	78,3		78,2	78,3	775	96,8	101,6
450	478		76,1	84,6		84,7	93,2	705	81,7	87,5	705	86,2	92,8		113,9	119,6
500	529		82,8	96,9		92	106	775	98,3	107,8	775	103,4	112,8		124,9	134,3
600	630		96,4	113,2		107,8	123,6		124,3	135,6	835	129,3	141,6	835	147,2	157,5
700	720		107,3	130,2		120	142,9	835	141,3	154,5		148	161,8		168,1	180,4
[illegible]	[illegible]	625	121,7	147,9	625	134,6	160,8	775	151	165	—	—	—	—	—	—
[illegible]	[illegible]		146,4	177,9		162,3	191,8		168,1	184,9						

Continuation Table 4.

1000	1030		165	200,8		180,4	216,1	775	184,9	208,6	—	—	—	—	—	—
1200	1220	665	204	274,9	665	222	292,9	—	—	—	—	—	—	—	—	—
1400	1420		235,7	318,1	—	—	—	—	—	—	—	—	—	—	—	—
1500	1520		254,7	350,7	—	—	—	—	—	—	—	—	—	—	—	—
1600	1620	705	271,9	374,4	—	—	—	—	—	—	—	—	—	—	—	—
1800	1820		302,2	417,8	—	—	—	—	—	—	—	—	—	—	—	—
2000	2020		338	478,6	—	—	—	—	—	—	—	—	—	—	—	—
2200	2220	785	406,8	580,5	—	—	—	—	—	—	—	—	—	—	—	—
2400	2420		442,6	610,9	—	—	—	—	—	—	—	—	—	—	—	—

Notes: 1. Sizes/dimensions D and H are given in Table 2;

2. Other notes see in tables 6.

Key: (1). kg/cm². (2). mass. (3). without sleeve/beaker. (4). with sleeve/beaker.

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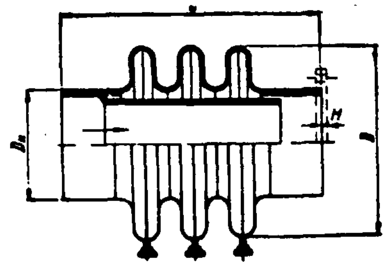
3. Three-lens compensators.



(1) Тип I — со стаканом (МН 2894-62)
(2) Тип II — без стакана (МН 2895-62)

Key: (1). Type I - with sleeve/beaker (MN 2894-62). (2). Type II - without sleeve/beaker (MN 2895-62).

Table 5. Sizes/dimensions in mm and mass in kg. of three-lens compensators (without flanges).

D_y	$D_н$	P_y, кгс/см² (1)														
		0,2			1			2,5			4			6		
		L	(2) масса		L	(2) масса		L	(2) масса		L	(2) масса		L	(2) масса	
			(3) без стакана	(4) со стаканом		(3) без стакана	(4) со стаканом		(3) без стакана	(4) со стаканом		(3) без стакана	(4) со стаканом		(3) без стакана	(4) со стаканом
[illegible]	108	665	27,3	26,9	665	27,3	26,9	605	15	16,7	605	15	16,7	645	19,4	21,1
[illegible]	133		29,6	32,8		29,6	32,8		17,7	20,4		17,7	20,4	685	23,5	25,7
[illegible]	[illegible]		35,9	39,7		35,9	39,7		21,5	24,1		21,5	24,1		29,3	31,8
[illegible]	[illegible]	725	40	44,9	725	40	44,9	645	24,8	28	645	24,8	28	745	33,1	36,4
[illegible]	219		43,5	48,8		43,5	48,8		30,9	34,5		30,9	34,5		40,7	44,3
[illegible]	273		50,9	57,6		50,9	57,6		41	45,5		44,6	49,2		58,1	63,7
[illegible]	[illegible]		61,4	69,4		61,4	69,4	745	52,1	58,6	745	58,2	63,7		75,3	80,8
350	377		75,5	85		85,5	96		72,9	79,3		76,8	85,2		105,6	112
400	426	725	88,6	99,5	725	100,2	111		85,9	93,2		93,3	100,6	875	117,7	124,9
450	478		96,9	109,2		109,7	122	805	95,5	103,7	805	103,7	111,9		137,1	147,3
500	529		105,1	125,5		118,8	139,2	875	113,6	127,1	875	121,1	134,7		149,9	162,5
600	630		121,8	146,2		137,3	161,8		141,7	158,1		150,7	167,1	935	175	191,4
700	720		135,7	167,9		154,6	186,8	935	160,8	179,7	935	170,9	189,8		198,4	217,4
800	820	785	153,6	190,4	785	172,9	209,8		172,1	193,5	—	—	—	—	—	—
900	920		190,4	231,8		211,2	252,6	875	192,6	216,7	—	—	—	—	—	—

Continuation Table 5.

1000	1020		211,8	262,2	845	234,7	285,2	875	211,4	238	—	—	—	—	—	—
1200	1220	845	258,5	358,4		285,4	385,3	—	—	—	—	—	—	—	—	—
1400	1420		297,8	414,2	—	—	—	—	—	—	—	—	—	—	—	—
1500	1520		322,5	458,7	—	—	—	—	—	—	—	—	—	—	—	—
1600	1620	905	343,5	489	—	—	—	—	—	—	—	—	—	—	—	—
1800	1820		381,6	546	—	—	—	—	—	—	—	—	—	—	—	—
2000	2030		428,9	633,5	—	—	—	—	—	—	—	—	—	—	—	—
2200	2230	1025	505,7	729,3	—	—	—	—	—	—	—	—	—	—	—	—
2400	2430		549,8	794,6	—	—	—	—	—	—	—	—	—	—	—	—

Note: 1. Sizes/dimensions D and H are given in Table 2.

2. Other notes see in Tables 6.

Key: (1). kg/cm². (2). mass. (3). without sleeve/beaker. (4). with sleeve/beaker.

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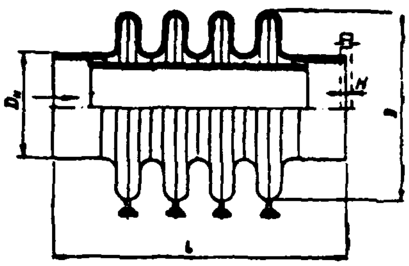
4. Four-lens compensators.



(1) Тип I — со стаканом (МН 2894-62)
(2) Тип II — без стакана (МН 2895-62)

Key: (1). Type I - with sleeve/beaker (MN 2894-62). (2). Type II - without sleeve/beaker (MN 2895-62).

Table 6. Sizes/dimensions in mm and mass in kg. of four-lens compensators (without flanges).

D_y	$D_н$	P_y, кгс/см² (1)														
		0,2			1			2,5			4			6		
		L	(2) масса (3) без стакана	(4) со стаканом	L	(2) масса (3) без стакана	(4) со стаканом	L	(2) масса (3) без стакана	(4) со стаканом	L	(2) масса (3) без стакана	(4) со стаканом	L	(2) масса (3) без стакана	(4) со стаканом
100	108	785	30,8	34,2	785	30,8	34,2	705	18,4	20,7	705	18,4	20,7	745	24,1	27,3
125	133		37,5	41,7		37,5	41,7		21,5	24,5		21,7	24,5	785	28,9	31,8
150	159		45,5	50,4		45,5	50,4		25,9	29,3		25,9	29,3		35,4	38,6
175	194	865	50,4	56,7	865	50,1	56,7	745	29,7	33,9	745	29,7	33,9	845	39,9	44,2
200	219		54,7	61,7		54,7	61,7		36,4	41		36,4	41		48,2	52,9
250	273		63,1	71,8		63,1	71,8		47,7	53,6		52,5	58,4		68,5	74,5
300	325		75	85,5		75	85,5	845	61,2	68,3	845	68	75,1	975	88,2	95,3
350	377		90,8	103,3		105,1	117,6		84,7	93		92,9	101,3		124,9	133,2
400	426		108	122,2		123,3	137,5	905	98,7	108,1	905	108,5	117,9		138,8	148,3
450	478		117,7	133,7		134,7	150,7	905	109,2	119,9	905	120,2	130,9		160,3	171,1
500	529	865	127,4	153,8	865	145,7	172,5	975	128,8	145,9	975	138,8	156,5	1035	175	192,7
600	630		148,1	179,3		167,9	200	1035	159,2	150,4	1035	171,1	192,3		202,8	225
700	720		164	206,5		189,2	231,7		180,4	204,9		193,8	218,2		230,7	255,2
800	820	945	185,5	234,2	945	211,2	260		194,4	222	—	—	—	—	—	—
900	920		232,4	287		260,1	314,8	975	217,1	248,5	—	—	—	—	—	—
1000	1020		258,6	323,9		288,4	354,5		237,1	282,6	—	—	—	—	—	—
1200	1220	1025	312,9	442,3	1025	348,8	478,2	—	—	—	—	—	—	—	—	—
1400	1420		[illegible]	510,8	—	—	—	—	—	—	—	—	—	—	—	—

Continuation Table 6.

1500	1830		389,6	865,1	—	—	—	—	—	—	—	—	—	—	—	—
1600	1620	1105	415	601,5	—	—	—	—	—	—	—	—	—	—	—	—
1800	1820		460,8	671,4	—	—	—	—	—	—	—	—	—	—	—	—
2000	2020		519,7	787,3	—	—	—	—	—	—	—	—	—	—	—	—
2200	2220	1265	604,5	898,2	—	—	—	—	—	—	—	—	—	—	—	—
2400	2420		667,1	977,8	—	—	—	—	—	—	—	—	—	—	—	—

Notes: 1. Sizes/dimensions D and H are given in Table 2.

For P_y=2,5 kg/cm² and internal diameters D_y from 100 to 200 mm to use compensators P_y=4 kg/cm²; for P_y=0,5 kg/cm² and internal diameters D_y from 100 to 300 mm to use compensators P_y=1 kg/cm².

3. Tables show mass of compensator with vent lines. The mass of compensators without vent lines is respectively less by 0.1 kg. to each lens.

4. Misalignment of entrance and exit openings of compensator is allowed/assumed to 3 mm for $D_y<250$ mm and to 5 mm for $D_y>300$ mm.

5. Nonperpendicularity of ends/faces of branch connections with respect to longitudinal axis of compensator must not exceed: for D_y=100÷200 mm - 1.5 mm; for D_y=250÷400 mm - 2 mm; for D_y=450÷700 mm - 2.5 mm; for D_y=800÷1200 mm - 3 mm; for $D_y>1200$ mm - 3.5 mm.

Key: (1). kg/cm^2. (2). mass. (3). without sleeve/beaker. (4). with sleeve/beaker.

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2. Wavy compensators.

Wavy compensators are the most modern compact compensators, which make it possible to establish/install them in the small section of the route of conduits/manifolds.

The basic part of the wavy compensators of different types is the pliable element/cell, which consists of elastic and strong that corrugated in the form of the waves of shell, manufactured made of steel OKh18N10. Wave development (corrugation) is accomplished/realized by hydraulic molding.

Depending on load direction pliable element/cell absorbs the strains of different character (Fig. 5).

For technological conduits/manifolds use wavy kilooha compensators axial (KVO2), general-purpose hinged (KVU2) and hinged dual (KVSh), developed by designed committee Giproneftemash [State Scientific Research and Planning Institute of Petroleum Machinery Manufacture].

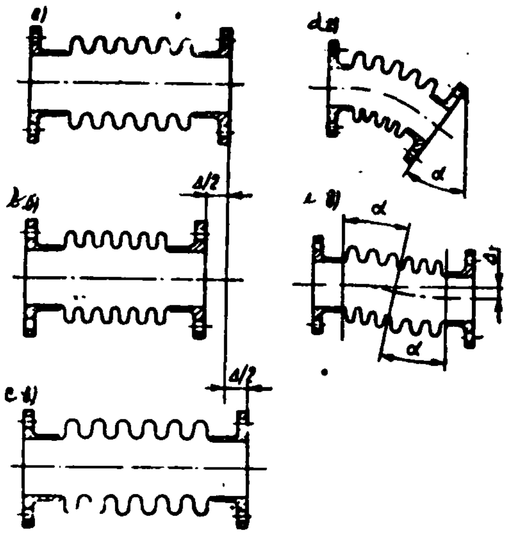

Fig. 5. Basic concepts of the strain of pliable element/cell. a) the initial position of the compensator; b) the compression of compensator along the longitudinal axis; c) the stretching of compensator along the longitudinal axis; d) the bend of compensator at the angle; e) the displacement of longitudinal axis with the parallelism of the planes of the ends of the pliable element/cell.

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Wavy compensators work under conditions of alternating load with the change of cycles from maximum to the minimum of the temperature parameters.

Table 7 gives the data about the maximum permissible angles of

bend of the waves of a compensator of the type KVU2 on P_y=25 kg/cm² during 300 repeating cycles for entire period of operation.

The limits of the use/application of wavy compensators on the pressure of medium depending on temperature are set to GOST 356-68.

Wavy compensators depending on their construction/design are intended for a work at temperature from -30 to +450° and P_y <25 kg/cm².

Axial type wavy compensators KVO2 establish/install in the straight/direct sections of conduits/manifolds.

The general view of compensator KVO2 is shown in Fig. 6.

Pliable element/cell has the omega-shaped profile/airfoil of waves and the limiting rings, bent from round bar. Pliable element/cell is welded to ring branch connections. The carrier rings are applied to the connection of pliable element/cell with branch connections in hot state. Jacket is welded to the strut, which holds from shift/shear the carrier rings; the housing with disks protects plia element/cell from accidental shocks and damages and contributes to the decrease of heat losses.

Table 7. Permissible angles of bend of the waves of compensator KVU2.

D_y, мм	(1) Максимально допустимый угол изгиба одной волны при 300 циклах	(2) Максимально допустимые углы изгиба для числа волн		
		3	4	6
150	1°40′	5°	6°40′	10°
200, 250, 350	1°30′	4°30′	6°	9°
300, 400	1°20′	4°	5°20′	8°

Key: (1). Maximum permissible angle of bend of one wave during 300 cycles. (2). Maximum permissible angles of bend for number of waves.

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The flange, welded with jacket, bolts and nuts serve for installation and preliminary brace to the prescribed/assigned length, but the disk, welded to branch connection, protects from the displacement of heat insulation. Internal shell decreases the turbulence of the transported medium.

The technical characteristics of compensators KVO2 are given in Table 8.

The wavy compensators of the type KV02 and others are produced by the Salavatsk Machine Building Plant for the drawings, developed by design institute Giproneftemash.

Compensators hinged type wavy angular ones KVU, KVU2 and KVSh establish in sections with significant temperature drops or at large distances between rigid supports to which they are transmitted comparatively small efforts/forces.

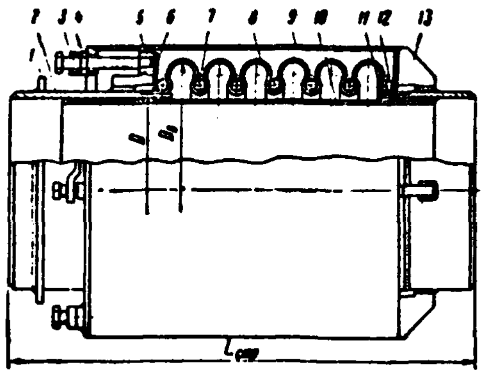

Fig. 6. Compensator wavy axial of the type KV02 on 25 kg/cm². 1. disk; 2, 11 - ring branch connections; 3, 4 - bolts and nuts; 5 - flange; 6 - disks; 7 - limiting bent rings; 8 - corrugated pliable element/cell; 9 - jacket; 10 - internal shell; 12 - carrier rings; 13 - strut.

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Table 8. Technical characteristic of compensators KV02 for $P_y \leq 25$ kg/cm² (OST 26-02-225-70).

D_y, мм	(1) Размеры присоединяемой трубы в мм	(2) Наибольшая компенсирующая способность одной волны Δ	(3) Число волн	(4) Толщина стенки гибкого элемента в мм	(5) Диаметр гибкого элемента в мм		(6) Строительная длина L при числе волн в мм					(7) Масса компенсатора с кольцами круглого сечения в кг при числе волн				
					D	$D_в$	3	4	6	8	10	3	4	6	8	10
150	159×7	10	3—8	1	157	236	391	436	526	616	—	25	28	33	39	—
200	219×8	12	3—8	1,2	216	313	464	518	676	734	—	45	50	60	70	—
250	273×9	14	3—8	1,2	270	367	507	562	672	782	—	60	65	75	90	—
300	325×10	14	3—8	1,2	321	418	507	562	672	782	—	70	80	90	105	—
350	377×10	18	3—10	1,2	372	493	643	712	850	988	1126	110	120	145	170	195
400	426×11	18	3—10	1,2	421	542	643	712	850	988	1126	125	140	165	196	220

Key: (1). Sizes/dimensions of the added duct in mm. (2). Greatest compensation capacity of one wave. (3). Number of waves. (4). Wall thickness of pliable element in mm. (5). Diameter of pliable element/cell in mm. (6). Structural length L with number of waves in mm. (7). Mass of compensator with rings of round cross-section in kg. with number of waves.

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Compensators of the type KVU are used with the broad band of the distances between centers of the hinge joints of the compensators; the bend of hinge joints is accomplished/realized only in one plane.

The general view of compensator KVU is shown in Fig. 7.

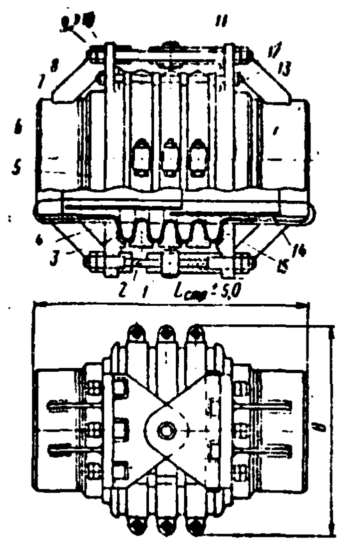

Fig. 7. Compensator wavy of the type KVU. 1 - hinge joints; 2 - the collars; 3 - pliable corrugated element/cell; 4 - the carrier rings; 5 - strip rings; 6 - ring branch connections; 7 - stiffening rib; 8 - pin; 9, 10 and 12 - nut; 11 - adapter; 13 - pin; 14 - shell cylindrical; 15 - shell conical.

Table 9. Technical characteristic of compensators KVU2 on $P_y \leqslant 25$ kg/cm² (OST 26-02-332-71).

D_y, мм	(1) Строительная длина L в мм при числе волн			(2) Масса в кг при числе волн			(3) B в мм, не более
	3	4	6	3	4	6	
150	471	516	606	40	42	50	342
200	564	618	726	75	80	95	433
250	617	672	782	115	125	140	510
300	617	672	782	125	135	155	[illegible]
350	803	872	1010	240	258	290	[illegible]
400	803	872	1010	258	275	310	[illegible]

Key: (1). Structural length L in mm with a number of waves. (2). Mass in kg. with number of waves. (3). B in mm, are not more.

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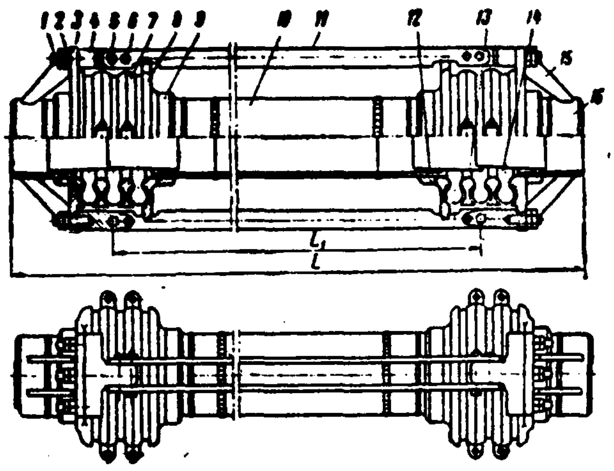
The technical characteristic of compensators KVU2 on $P_y \leq$ 25 kg/cm² with a diameter of 150-400 mm is given in Table 9.

Compensators hinged dual KVSh have two pliable elements/cells and are used them for absorbing the temperature changes of the lengths of conduits/manifolds in angular, Z-shaped and U-shaped systems and on branches.

The general view of compensator KVSh is shown in Fig. 8.

The technical characteristic of compensators KVSh on $P_y \leq$ 25 kg/cm² with a diameter of 150-350 mm is given in Table 10.



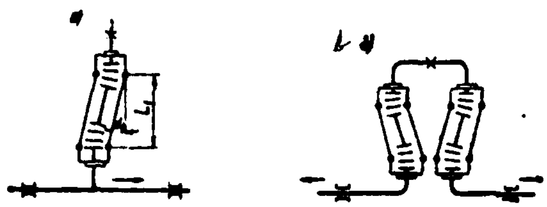


Fig. 8. Compensator hinged doubled of the type KVSh. a) installation on the branch; b) installation in the U-shaped diagram; 1 - pins; **2 - nut; 3 - the carrier rings; 4 - link of the hinge joints; 5 - fulcrum; 6 - bolts; 7 - limiting semirings; 8 - the carrier rings; 9 - strip rings; 10 - spacer duct; 11 - draft (illegible); 12 - shell cylindrical; 13 - pliable corrugated elements/cells; 14 -** conical shell; **15 - connection plate; 16 - branch connections.**

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§4. Slipping type axial compensators (gasket).

Gasket compensators are established/installed in steam- and heat- cables, and also in the conduits/manifolds, which transport unburning liquids, their vapors, and inert gases. The installation of gasket compensators to the conduits/manifolds, which transport toxic products, combustible and reactive gas, inflammable and flammable liquids, is not allowed/assumed.

Compensators with conduit/manifold weld or from flanges.

Types and sizes/dimensions of steel gasket compensators on P_1 to 16 kg/cm² from D_y from 100 to 1000 mm for the conduits/manifolds, which transport nonagressive products at temperature to 300°C are standardized (see the standards of machine building MN 2593-61 -MN 2599-61).

The information about these compensators is given in table 11.

Table 10. Technical characteristic of compensators KVSh on $P_y \leq 25$ kg/cm².

D_y, мм	(1) Компенси-рующая способ-ность, Δ	(2) Строи-тельная длина L, мм	(3) Расстоя-ние между осями шар-ниров L_1, мм	(4) Масса компен-сатора в кг
150	200	1200	838	86
	300	1600	1238	93,6
	400	2020	1658	108
	500	2420	2058	112
200	200	1380	910	178
	300	1820	1350	214
	400	2280	1810	243
	500	2720	2250	276
250	200	1400	876	188
	300	1880	1356	209
	400	2280	1756	231
	500	2700	2176	264
300	200	1520	996	282
	300	2030	1496	337
	400	2520	1996	392
	500	3000	2476	445
350	200	1480	928	[illegible]
	300	1920	[illegible]	464
	400	[illegible]	[illegible]	[illegible]
	500	[illegible]	[illegible]	[illegible]

Key: (1). Compensation capacity, Δ. (2). Structural length L, mm. (3). Distance between centers of hinge joints L_1, mm. (4). Mass of compensator in kg.

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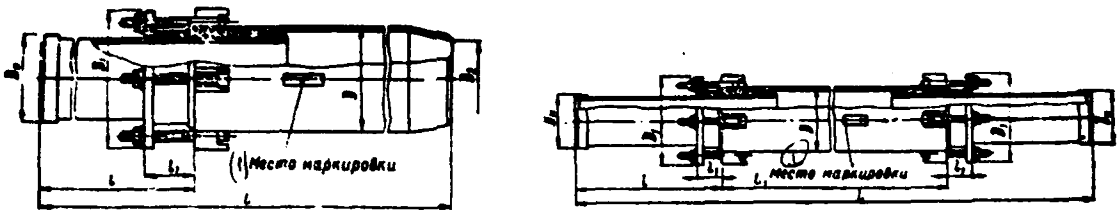
Table 11. Compensators gasket mono- and two-sided on P_y to 16 kg/cm²
(MN 2593-61 and MN 2598-62).



(2) Условный проход трубопровода D_y, мм	(3) Наибольшая компенсирующая способность компенсатора в мм: (6) одностороннего	(7) двустороннего	(4) Размеры в мм: $D_н$	D	D_1	D_2	(8) L компенсатора: (6) одностороннего	(7) двустороннего	L_1	l	l_1	(5) Масса компенсатора в кг: (6) одностороннего	(7) двустороннего
100 125	250	2×250	108 133	133 159	190 215	100 125	820 835	1620	870	375	65	20,5 25,4	41,6 49,9
150 175			159 194	194 219	250 280	150 184	990 965	1900	1030	435	75	43,8 49,9	86,4 100
200 250 300 350	300	2×300	219 273 325 377	273 325 377 426	345 395 450 500	205 259 307 359	1160 1150 1170 1175	2160	1180	490	120	92 125,9 158 167	177 243 305 318
400			426	478	560	412		2560	1380		120	212	406
450			478	529	610	464	1360					243	468
500			529	578	675	515	1370					333	651
600			630	680	780	614	1375					400	784
700	400	2×400	720	774	875	704	1380	2620	1440	590	130	479	939
800			820	874	980	802	1385					600	1169
900			920	974	1085	900						687	1339
1000			1020	1070	1165	[illegible]	1390					[illegible]	[illegible]

Notes: 1. Size/dimension D_2 of one-sided compensator corresponds to the bore of the added conduit/manifold.

2. Material - st. 3 about GOST 380-71.

3. During installation of compensator with compensation capacity less than it is shown in table, adjusting values L and l can be respectively reduced.

Key: (1). Place of marking. (2). Conventional flow capacity of conduit/manifold D_y, mm. (3). Greatest compensation capacity of compensator in mm. (4). Sizes/dimensions in mm. (5). Mass of compensator in kg. (6). one-sided. (7). two-sided.

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Chapter VI.

DUCTS AND PARTS OF PRESSURE PIPING.

§1. Classification of conduits/manifolds on P_y from 200 to 1000 kg/cm².

Technological conduits/manifolds to conventional pressure from 200 to 1000 kg/cm² classify:

a) according to the properties of the transported media: groups A, B, C, D and E in accordance with the classification of conduits/manifolds, established/installed by SniP III-G.9-62* (see Chapter I, §3);

b) on the pressure of the transported media: P_y =200; 250; 320; 400; 500; 640; 800 and 1000 kg/cm²;

c) according to the temperature of the transported media and using materials of conduit/manifold.

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§2. Requirements for steels for conduits/manifolds on p_y from 200 to 1000 kg/cm².

When selecting of materials for conduits/manifolds consider operational characteristics, corrosion properties of medium, character the load applications.

Depending on the value of operating pressure, temperature and characteristic of working medium are determined the group of steel and the permissible conventional pressure.

In accordance with this the ducts and the parts of the conduits/manifolds of any internal diameter by outside diameters and wall thicknesses divide into I, II, III and IV performance.

Table 1. Classification of pressure piping depending on temperature and pressure of the transported medium.

(1) Температурная ступень	(2) Температура транспортируемой среды в °C	(3) Группа стали	(4) P_y, кгс/см²	(5) Характеристика среды
I	(6) От −50 до +200	С	200—320	(7) Нейтральная, водородосодержащая
		ХН		(8) Агрессивная
I	(6) От −50 до +300	ХГ	400—640	(7) Нейтральная, водородосодержащая
II	(6) От −50 до +400	ХМ	250—800	(9) То же
III	(6) От −50 до +510	ХФ	320—1000	»

Notes: 1. Groups of steel are given according to GOST 356-68.

2. Temperature steps/stages and conventional pressures - according to GOST 9400-63.

3. Characteristic of medium - on MN 5010-63.

Key: (1). Temperature step/stage. (2). Temperature of transported medium in °C. (3). Group of steel. (4). kg/cm². (5). Characteristic of medium. (6). From -50 to . (7). Neutral, which contains hydrogen. (8). Aggressive. (9). The same.

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The permissible maximum values of conventional pressures for the groups of steels and corresponding to it performance are given in Table 2.

The trademarks of steels used for ducts and parts of conduits on P_y =200-1000 kg/cm², are given in Table 3.

Table 2. Performance of ducts and parts depending on the conventional pressure of conduits/manifolds and group of steel.

(1) Исполнение	(2) Группа стали				
	С	ХГ	ХМ	ХФ	ХН
	P_y, кгс/см² (3)				
I	200	—	250	320	200
II	320	—	400	500	320
III	—	500	640	800	—
IV	—	640	800	1000	—

Key: (1). Performance. (2). Group of steel. (3). kg/cm².

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Table 3. Trademarks of steels of ducts and parts for conduits/manifolds on p_y=200-1000 kg/cm².

(1) Группа стали (ГОСТ ...—63)	(2) Трубы	(3) Колена, угольники, тройники, отводы, переходы, диафрагмы, линзы, карманы	(4) Фланцы переходные, заглушки	(5) Фланцы под термометры и термопары	(6) Фланцы резьбовые	(7) Линзы уплотнительные	(8) Шпильки	(9) Гайки чистые шестигранные
	ЧМТУ ВНИТИ 518-63, 3-248-69 и (and) МН 5010-63				ГОСТ 9399—63	ГОСТ 10493—63	ГОСТ 10494—63	ГОСТ 10495—63
	(10) Марка стали							
С	20	20	35	35	35	20	35ХГ2	30Х; 35Х; 30ХМА
ХГ	14ХГС 18ХГ 15ХФ	18ХГ	30Х	35	35 30Х	20 18ХГ	35ХГ2	30Х; 35Х; 30ХМА
ХМ	30ХМА 18Х3МВ	30ХМА 18Х3МВ	30ХМА 18Х3МВ	40Х	38ХА или (or) 40Х	Х3МВ	40ХФА	35Х; 30ХМА
ХФ	20Х3МВФ	20Х3МВФ	20Х3МВФ	25Х1МФ	25Х2МФА	Х3МВ	25Х2МФА	30ХМА
ХН	Х18Н10Т 0Х17Н16М3Т	Х18Н10Т Х17Н13М3Т	Х18Н10Т(35) Х17Н13М3Т(35)	35	35	Х18Н10Т Х17Н13М3Т	35ХГ2	30Х; 35Х; 30ХМА

Notes: 1. Material - steel of the brands/marks: 20, 35 according to GOST 1050-60; 18KhG, 30Kh, 35Kh, 35KhG2, 38KhA, 40Kh, 30KhMa, 15KhF, 40KhFA according to GOST 4543-71; 14KhGS according to GOST 5058-57; Kh18N10T, Kh17N13M3T, 0Kh17N16M3T according to GOST 5632-61*; 18Kh3MV, 20Kh3MVF, 25Kh1MF according to GOST 10500-63; Kh3MV according to GOST 10493-63; 25Kh2MFA according to the technical specifications, approved in routine.

2. For agressive media of different productions besides given trademarks of steels also they supply according to appropriate standards and special technical specifications of duct and part of conduits/manifolds from flock of brands Kh25N20S2, Kh23N18, Kh17N13M3T and Kh17N13M2T.

3. For transitional flanges and silencers/plugs on MN 4994-63 and MN 4996-63 inserts prepare from steels of brands Kh18N10T and Kh17N13M3T; remaining parts - from flock of brand 35.

Key: (1). Group of steel. (2). Ducts. (3). Elbows, angle plates, T-connections, offtakes, transitions, diaphragms, lens, pockets. (4). flanges (transitional, silencers/plugs). (5). flanges under thermometers and thermocouples. (6). Flanges (threading. (7). Lens packing. (8). Pins. (9). Nuts pure/clean hexahedral. (10). Trademark of steel.

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Table 4. Assortment of ducts on P_y = 200-1000 kg/cm² (ChMTU VNITI [ЧМТУ] 518-63 with addition No 1 and TSPM/VNITI 3-248-69) (sizes/dimensions in mm, mass in kg.).

D_y	(1) Группа стали											
	С, ХГ, ХМ, ХФ								ХН			
	$D_н \times S$	(2) масса 1 пог. м	$D_н \times S$	(2) масса 1 пог. м	$D_н \times S$	(2) масса 1 пог. м	$D_н \times S$	(2) масса 1 пог. м	$D_н \times S$	(2) масса 1 пог. м	$D_н \times S$	(2) масса 1 пог. м
6	12×3	0,67	15×4,5	1,17	—	—	—	—	12×3	0,69	15×4,5	1,18
10	20×4,5	1,72	25×7	3,11	—	—	—	—	20×4,5	1,77	25×7	3,13
15	25×5	2,47	35×9	5,77	—	—	—	—	25×5	2,54	35×9	5,81
25	35×5	3,7	45×9	7,99	45×10	8,63	50×12	11,25	35×5	3,82	45×9	8,06
32	45×6,5	6,17	50×9	9,1	57×12	13,32	68×16	20,52	45×6,5	6,37	50×9 / 51×11	9,16 / 10,92
40	57×7	8,63	68×12	16,57	68×14	18,64	83×19	29,99	57×7	8,91	68×12	16,67
60	76×9	14,87	83×14	23,82	102×20	40,44	102×22	43,4	76×9	15,32	83×14	24,02
70	89×11	21,16	102×16	33,93	114×22	49,91	127×28	68,36	89×11	21,82	102×16	34,13
90	114×14	34,53	127×18	48,39	140×25	70,9	159×36	109,2	114×14	35,61	127×18	48,66
100	127×14	39,01	140×20	59,19	159×28	90,46	180×40	138,1	127×14	40,24	140×20	59,54
125	159×18	62,59	180×28	104,96	194×36	140,27	219×48	202,41	159×18	64,54	180×28	105,55
150	194×20	85,28	219×32	147,57	245×45	221,96	273×60	315,17	194×20	88,51	—	—
200	245×25	135,64	273×38	220,23	299×50	307,02	—	—	—	—	—	—

Note. Mass 1 lin. m of ducts for the groups of steels S, KhG, KhM and KhF determine from the formula

$$G = \frac{\pi}{1000}(D_н - S)S\gamma,$$

where γ - steel density is accepted by 7.85; for the groups of steels KhN, density is accepted equal to 8.1 for steel 0Kh17N16M3T (EI580) and 7.9 for steel Kh18N10T.

Key: (1). Group of steel. (2). mass of 1 lin. m.

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§3. Conduits on p_y from 200 to 1000 kg/cm².

1. Ducts.

For manufacturing technological pressure piping by technical specifications is established/installed the limiting assortment of ducts with 13 internal diameters.

Ducts made of steel of groups S, KhG, KhM, SF supply in accordance with TSFM VNITI 518-63, while ducts made of steel KhN supply on TSFM VNITI 3-248-69.

The assortment of ducts for communications by pressure from 200 to 1000 kg/cm² is given in tables 4.

Technical requirements for ducts made of steels of group S, KhG, KhM and KhF (ChMTU VNITI 518-63).

Ducts in outside diameter to 57 mm inclusively supply cold-rolled and cold-drawn, more than 57 mm - hot-rolled. Is

permitted the delivery of ducts by those cold-worked of the following sizes/dimensions: 68x12, 68x14, 76x9 and 83x14-19 mm.

The length of the supplied ducts must be not less than 4.5 mm: is allowed/assumed the delivery of ducts in long not less than 3 m in quantity 20o/o of ordered batch.

Deviations with respect to the sizes/dimensions of ducts must not exceed the values, given in Table 5.

Ovality and wall thickness variation of ducts must not derive/conclude the sizes/dimensions of ducts beyond the limits of manufacturing tolerances with respect to diameter and wall thickness. The curvature of ducts in the section of any length must not exceed: for the cold-rolled and cold-drawn ducts - 1.5 mm on 1 m, for the hot-rolled ducts:

with wall thickness to 20 mm ... 1.5 mm by 1 lin. m;

the same, more than 20 mm to 30 mm ... ~~3~~ 2 mm by 1 lin. m;

the same, more than 30 mm ... 4 mm by 1 lin. m.

Table 5. Manufacturing tolerances with respect to the sizes/dimensions of ducts made of steels of group S, KhG, KhM, KhF.

(1) Размер труб	(2) Холоднотянутые и холоднокатаные	(3) Горячекатаные
	(4) допускаемые отклонения	
(5) При наружном диаметре: до 30 мм свыше 30 мм до 50 мм » 50 мм	 ±0,3 мм ±0,4 » ±0,8 %	(6) ±1% (для всех размеров)
(7) При толщине стенки: до 5 мм свыше 5 »	 ±10% ± 8%	(6) −8% +15% (для всех размеров)

Key: (1). Size/dimension of ducts. (2). Cold-drawn and cold-rolled. (3). Hot-rolled. (4). manufacturing tolerances. (5). With outside diameter: to 30 mm, it is more than 30 mm to 50 mm, more than 50 mm. (6). (for all sizes/dimensions). (7). With wall thickness: to 5 mm, it is more than 5 mm.

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Mechanical properties of the metal of ducts in the state of delivery must to satisfy the requirements Table 6.

To inspection and measurement is subjected each duct. On the external and internal surfaces of ducts are not allowed/assumed the flaws, cracks, laps, deep scratches and hairline cracks. These

defects/flaws compulsorily derive/conclude via trimming by grinding wheel, file or in another manner, except verification and calking. In this case in the cleaned places wall thickness must not exceed the limits of manufacturing tolerances.

Ducts must hold out the testing (hydraulic) pressure, determined according to GOST 3845-65 (see Chapter I, §2).

Table 6. Mechanical properties of steels of ducts in as-received condition on p_y from 200 to 1000 kg/cm² (TSPM VNITI 518-63 and 3-248-69).

(1) Марка стали	$\sigma_в$ (2) кгс/см²	$\sigma_т$ (2) кгс/см²	δ_{10} %	δ_5 %	(3) $a_н$ кгс·м/см²	HB
	(4) не менее					
20	42—40	24	—	23	6	111—186
14ХГС	50	34	17	—	10	(4) Не менее 137
18ХГ	55	35	—	20	12	» 179
15ХФ	45	25	—	20	—	(5) Не более 187
30ХМА	60	40	13	—	8	169—217
18Х3МВ	65	45	—	18	12	197—241
20Х3МВФ	80	50	—	14	6	241—285
Х18Н10Т:						
(6) горячекатаные	54	40	—	—	—	—
(7) холоднокатаные	56	35	—	—	—	—
0Х17Н16М3Т	50	20	—	36	(8) Факультативно	

Notes: 1. For ducts of steel of brand 20 with the wall thickness of duct to 20 mm $\sigma_в$ =42 kg/mm² and with wall thickness it is more than 20 mm $\sigma_в$ =40 kg/mm².

2. Mechanical properties of ducts of trademarks of steel Kh25N20S2, Kh23N18, Kh17N13M3T and Kh17N13M2T, supplied by special technical specifications, determine by agreement of sides.

Key: (1). the trademark of steel. (2). kg/cm². (3). kg·m/cm². (4).

it is not less. (5). It is not more. (6). hot-rolled. (7). cold-rolled. (8). Optional.

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Ducts in outside diameter less than 45 mm are tested to knee according to GOST 3728-66 (around mount/mandrel radius equal to 2D.). Ducts in outside diameter 45 mm and more are tested to flattening according to GOST 8695-58.

Each batch of ducts they accompany by the certificate, which certifies compliance of ducts to the requirements of specifications.

In certificate they indicate: the brand/mark of flock, its chemical composition, number of melting, all test results of ducts and blanks, sizes/dimensions and quality of ducts in batch, mode/conditions of the heat treatment of ducts, and also estimation of brands/marks and microsections, the appropriated color colorings of this brand/mark of steel and the output of OTK of manufacturing plant about aptitude.

At the end of each duct in outside diameter 35 mm and more compulsorily are selected the marks with the following data: the trademark of steel, the mark of manufacturing plant and its OTK and

number of batch. Marks hammer out at a distance of 300-400 mm from the end of the duct.

Ducts in outside diameter less than 35 mm link into bundles and they supply with two metallic tags, hung up on the zinc plated wire from two sides to the bundle; on tags pack the same marks, and also sizes/dimensions of ducts.

The ducts, not equipped with certificates, cannot be allowed for utilization on high-pressure installations.

Technical requirements for ducts made of steels of the group KhN, supplied on TSFM VNITI 3-248-69.

Manufacturing tolerances with respect to outside diameter in wall thickness must not exceed the values, indicated in Table 7.

Remaining requirements must correspond for hot-rolled ducts GOST 9940-72, for cold-deformed - - GOST 9941-72.

Table 7. Manufacturing tolerances with respect to the sizes/dimensions of ducts made of steels of the group KhN.

(1) Размер труб	(2) Точность изготовления		
	(3) обычная	(4) повышенная	(5) высокая
(6) *Холоднодеформированные*			
(7) По наружному диаметру:			
от 10 до 30 *мм*	—	±0,3 *мм*	±0,3 *мм*
свыше 30 до 50 *мм*	—	±1%	±0,4 »
» 50 *мм*	—	±1%	±0,3%
(8) По толщине стенки:			
до 5 *мм*	—	+12,5%, −10%	±10%
свыше 5 »	—	±10%	±8%
(9) *Горячекатаные*			
(10) По наружному диаметру:			
до 140 *мм*	—	+1,25%, −1,75%	±1%
свыше 140 »	±1,5%	—	—
(11) По толщине стенки:			
до 20 *мм*	—	+10%, −12%	+15%, −8%
свыше 20 »	+12,5%, −15%	—	—

Key: (1). Size/dimension of ducts. (2). Manufacturing precision. (3). common. (4). increased. (5). high. (6). Cold-worked. (7). According to outside diameter: from 10 to 30 mm, it is more than 30 to 50 mm, more than 50 mm. (8). According to wall thickness: to 5 mm, it is more than 5 mm. (9). hot-rolled. (10). According to outside diameter: to 140 mm, it is more than 140 mm. (11). According to wall thickness: to 20 mm, it is more than 20 mm.

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2. Leads of the conduits/manifolds.

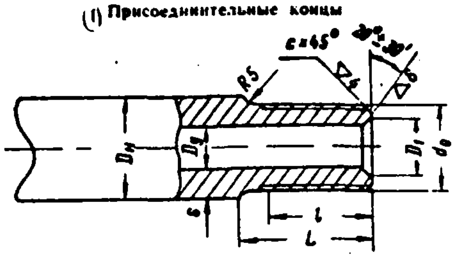
During manufacture and assembly of commercial conduits/manifolds

to pressure p_y from 200 to 1000 kg/cm² depending on design features and requirements of project are used flanged or welded joints.

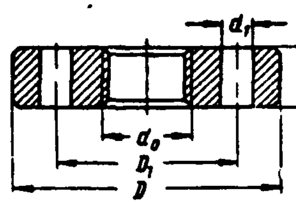
Leads for the elements/cells of conduits/manifolds for flanged screwed joints (under lens packing/seal) are given in Table 8.

Table 8. Ends the connecting threading for the elements/cells of conduits/manifolds under lens packing/seal (GOST 9400-63 and MH 4969-63) and flanges steel threading (GOST 9399-63) on P_y from 200 to 1000 kg/cm² (sizes/dimensions in mm, mass in kg.).

(1) Присоединительные концы



(2) Фланцы



D_y	(6) Исполнение	$D_н$	S	(3) Присоединительные концы d_0	D_1	L	l	c	(4) Фланцы D	D_1	b	d_1	(7) масса	(5) Шпильки (8) количество	(9) резьба
6	IV	15	4,5	M14×1,5	10	32	22	1	70	42	15	16	0,36	3	M14
10	IV	25	7	M24×2	18		28		95	60	20	18	0,93	3	M16
15	II	35	9	M33×2	28		35		105	68	20	18	1,1	3	M16
15	IV	35	9	M33×2	28	42	35		105	68	25	18	1,35	4	M16
25	II III	45 45	9 10	M42×2	37		35	1,5	115	80	25	18	1,88	4	M16
25	IV	50	12	M48×2	40	45	40		135	95	30	22	2,6	4	M20
32	II	50	9	M48×2	43		40		135	95	30	22	2,6	4	M20
32	III	57	12	M56×3	48		50		165	115	35	24	4,5	6	M22
32	IV	68	16	M64×3	55	60	50		165	115	35	24	4,25	6	M22
40 40	II III	68 68	12 14	M64×3	55		50	2	165	115	35	24	4,25	6	M22
40	IV	83	19	M80×3	65		55		200	145	40	29	7,04	6	M27
60	II	83	14	M80×3	72	65	55	2	200	145	40	29	7,04	6	M27
60	III; IV	102	20; 22	M100×3	82		65		225	170	50	33	10,5	6	M30
70	II	102	16	M100×3	90	75	65		225	170	50	33	10,5	6	M30
70	III	114	22	M110×3	95	80	70		245	185	55	33	14	6	M30
70	IV	127	28	M125×4	95	85	75	3	260	195	55	36	15	6	M33
90	I	114	14	M110×3	100	80	70	2	245	185	55	33	14	6	M30
90	II	127	18	M125×4	115	85	75		260	195	55	36	15	6	M33
80	III	140	25	M135×4	115	95	85		290	220	65	39	22,8	6	M36
80	IV	159	36	M155×4	120	100	90	3	300	235	70	39	23,2	8	M36
100	I	127	14	M125×4	115	85	75		260	195	55	36	15	6	M33
100	II	140	20	M135×4	125	95	85		290	220	65	39	22,8	6	M36
100	III	159	28	M155×4	132	100	90		300	235	70	39	23,2	8	M36
100	IV	180	40	M175×6	132	115	105	4	330	265	80	42	31,6	8	M39
125	I	159	18	M155×4	145	100	90	3	300	235	70	39	23,2	8	M36
125	II	180	28	M175×6	162	115	105		330	265	80	42	31,6	8	M39
125	III	194	36	M190×6	162	120	110		400	305	85	48	55,3	8	M45
125	IV	219	48	M215×6	165	130	120		400	315	95	48	55,8	8	M45
150	I	194	20	M190×6	175	120	110	4	400	305	85	48	55,3	8	M45
150	II	219	32	M215×6	195	130	120		400	315	95	48	55,8	8	M45
150	III	245	45	M240×6	195	140	130		480	360	105	55	84,5	8	M52
150	IV	273	60	M265×6	195	165	155		480	380	130	59	106	8	M56
200	I	245	25	M240×6	225	140	130		480	360	105	55	84,5	8	M52
200	II	273	38	M265×6	245	165	155		480	380	130	59	106	8	M56
200	III	299	50	M295×6	245	165	155		570	460	130	59	164	10	M56

Notes: 1. The material of ducts and flanges - see Table 3.

2. Thread metric - according to GOST 9150-59*, tolerances according to class of precision 2a - according to GOST 9253-59. The form of bottom of thread must be rounded.

3. Vanishing of thread at leads - according to GOST 10549-63*, angle of run of α=25°, value of run enters into size/dimension /.

4. Manufacturing tolerance of central angle whose sides pass through centers of two adjacent holes under pins in flanges, must not exceed 30'.

5. Faces of flanges must be perpendicular to axis/axle of thread. Deviation from perpendicularity must not exceed 20'.

6. Marking (ornamentation) flanges made of steel 38KhA or 40Kh must correspond to that indicated in Fig. 1, and flanges made of steel 25Kh2MFA - indicated in Fig. 2.

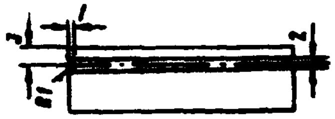


Fig. 1.

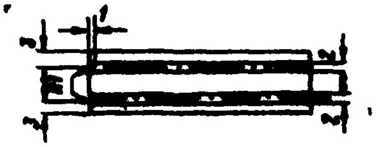


Fig. 2.

7. On external cylindrical surface of each flange they must be plotted/applied by marking: brand of manufacturing concern, designation of thread, number and trademark of steel.

8. Example of conventional designations of flange with thread M80x3 made of steel 38KhA: flange M80x38Kha of GOST 9399-63.

For flanges with thread M33x2 into designation is introduced a quantity of holes for the pins: M33x2=3 and M33x2=4.

Key: (1). Leads. (2). Flanges. (3). Leads. (4). flanges. (5). Pins. (6). Performance. (7). mass. (8). quantity. (9). thread.

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3. Parts of conduits/manifolds.

The enumeration of standards machine-buildings MN 4969-63-MN 5010-63 to the part of conduits/manifolds and **specifications on** P_y from 200 from 1000 kg/cm² with a diameter of D_y=6-200 mm are given in Table 9.

Elbows, angle plates, T-connections, transitions and other shaped parts, connected on flanges, supply in collection with the installed threading flanges and with all those completing separate articles by parts. Parts under weld supply from by the machined under weld ends on MRTU 26-01-9-67.

The parts of conduits/manifolds, which have the male thread,

must satisfy the following requirements:

a) the form of the hollow of the male threads must be rounded;

b) the play of the packing surface of leads of the relatively average/mean thread diameter must not exceed the values, indicated in Table 10.

All parts of conduits/manifolds stamp on manufacturing plant. the arrangement/position of marks is given in Table 22.

The conventional designations of the parts of conduits/manifolds in drawings and technical documentation include the following data: name of part, its internal diameter (for adapters - the internal diameters), conventional pressure, group of steel and the number of the standard of machine-building. In the designation of ducts additionally are connected their type and length.

The shaped parts of conduits/manifolds are prepared from forgings or stampings which in the heat-treated state must have mechanical properties and category of strength according to GOST 8479-70 (Table 11).

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Table 9. List of standards for conduits/manifolds on P_y =200-1000 kg/cm².

(1) Номер нормали	(2) Наименование деталей	(3) Номер таблицы
	(A.) Для разъемных соединений	
МН 4969-63	Трубы с фланцами	—
МН 4970-63	Линзы глухие с указателями	19
МН 4971-63	Штуцера	12
МН 4972-63	Отводы гнутые с фланцами	13
МН 4973-63	Колена с углом 90° с фланцами	14
МН 4974-63	Колена с углом 90° с фланцами и опорой	—
МН 4975-63	Колена с углом 90° неравноплечие с фланцами	11
МН 4976-63	Колена с углом 86° неравноплечие с фланцами и опорой	—
МН 4977-63	Колена с углом 94° неравноплечие с фланцами и опорой	—
МН 4978-63	Опоры для колен	—
МН 4979-63	Колена двойные с фланцами	—
МН 4980-63	Угольники с ответвлениями и фланцами	—
МН 4981-63	Тройники переходные с фланцами	15
МН 4982-63	Тройники проходные с ответвлениями и фланцами	—
МН 4983-63	Тройники переходные несимметричные с фланцами	—
МН 4984-63	Тройники переходные с фланцами	16
МН 4985-63	Тройники-вставки с фланцами	—
МН 4986-63	Переходы точеные с фланцами	17
МН 4987-63	Переходы штампованные с фланцами	18
МН 4988-63	Диафрагмы измерительные линзовые с фланцами	—
МН 4989-63	Отводы линзовые с фланцами	—
МН 4990-63	Угольники под термометры сопротивления и термопары	—
МН 4991-63	Фланцы под термометры сопротивления и термопары	—
МН 4992-63	Карманы под термометры сопротивления и термопары	—
МН 4993-63	Фланцы переходные	—
МН 4994-63	Фланцы переходные с вставкой	—
МН 4995-63	Заглушки	20
МН 4996-63	Заглушки с вставкой	20, 21
	(Б.) Для неразъемных соединений	
МН 4997-63	Трубы	—
МН 4998-63	Отводы гнутые	13
МН 4999-63	Колена с углом 90° и опорой	—
МН 5000-63	Колена с углом 86° неравноплечие с опорой	—
МН 5001-63	Колена с углом 91° неравноплечие с опорой	—
МН 5002-63	Колена двойные	—
МН 5003-63	Угольники с ответвлениями	—
МН 5004-63	Тройники переходные	15
МН 5005-63	Тройники переходные с ответвлениями	—
МН 5006-63	Тройники переходные несимметричные	—
МН 5007-63	Тройники-вставки	—
МН 5008-63	Переходы точеные	17
МН 5009-63	Переходы штампованные	18
МН 5010-63	Детали трубопроводов см. «Технические требования»	—

Key: (1). Number of standard. (2). Designation of parts. (3). Number of table. (A). For detachable joints. (4). Flanged tubes. (5). Lens (deaf with indicators). (6). Connecting pipe. (7). Offtakes, bent with flanges. (8). Elbows with angle of 90° with flanges. (9). Elbows with angle of 90° with flanges and support. (10). Elbows with angle of 90°, unequal-arm with flanges. (11). Elbows with angle of 86°, unequal-arm with flanges and support. (12). Supports for elbows. (13). Elbows (dual with flanges). (14). Angle plates with branches and flanges. (15). T-connections (transitional with flanges). (16). T-connections passage with branches and flanges. (17). T-connections transitional, asymmetric with flanges. (18). T-connections (transitional with flanges). (19). T-connection-insert with flanges. (20). Junctions (point with flanges). (21). Transitions, stamped/die-forged with flanges. (22). Diaphragms measuring lens with flanges. (23). Offtakes (lens with flanges). (24). Angle plates under resistance thermometers and thermocouple. (25). Flanges under resistance thermometers and thermocouple. (26). Karmans under resistance thermometers and thermocouple. (27). Flanges (transitional. (28). flanges (transitional with insert). (29). Silencers/plugs. (30). Silencers/plugs with insert. (B). For permanent compounds. (31). Ducts. (32). Offtakes, bent. (33). Elbows with angle of 90° and support. (34). elbow with angle of 86°, unequal-arm with support. (35). Elbows (dual. (36). Angle plates with branches. (37). T-connections transitional. (38). T-connections

(transitional with branches). (39). T-connections transitional asymmetric. (40). T-connection-insert. (41). transitions point. (42). Transition, stamped/die-forged. (43). Of parts of conduits/manifolds see "technical requirements".

Table 10. Allowable play of the packing surface of thread in mm.

D_y	6—10	15—32	40—70	80—100	125—200
(1) Допускаемое биение . . .	0,15	0,2	0,25	0,3	0,35

Key: (1). Allowable play.

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Table 11. Mechanical properties and categories of the strength of the metal of the parts of conduits/manifolds on P_y from 200 to 1000 kg/cm² according to GOST 8479-70 and ӨН 5010-63.

(1) Наименование деталей	(2) Марка стали	ГОСТ	(3) Категория прочности	(4) Механические свойства					
				$\sigma_в$ (5) кгс/см²	$\sigma_т$ (5) кгс/см²	δ_5 %	ψ %	(6) $a_н$ кгс·м/см²	НВ
(7) Фасонные детали	20	1050—60*	КП22	44	22	16—22	35—53	3,5—5,5	123—167
(8) Фланцы переходные и под термометры; заглушки	35	1050—60*	КП28	56	28	12—18	30—40	3—4	156—197
(9) Фланцы переходные, заглушки	30Х	4543—71	КП40А	63	40	14—17	40—45	5—6	187—229
(10) Фланцы под термометры	40Х	4543—71	КП56А	75	56	12—15	40—45	5,5—6,5	223—262
(11) Фасонные детали	18ХГ	4543—71	КП28	56	28	12—18	30—40	3—4	156—197
(12) Фасонные детали, фланцы переходные, заглушки	30ХМА	4543—71	КП45А	65	45	13—16	40—45	5—6	197—235
То же (13)	18Х3МВ	10500—63	КП45А	65	45	13—16	40—45	5—6	197—235
То же (13)	20Х3МВФ	10500—63	КП50А	80	60	11—14	40—45	5,5—6,5	235—277
(14) Фланцы под термометры	25Х1МФ	10500—63	КП63А	85	63	11—13	38—42	5,5—6,5	248—293
(15) Фасонные детали, фланцы переходные, заглушки	Х18Н10Т Х17Н13М3Т	10500—63 5949—61	— —	52 52	20 22	40 40	— —	— —	— —

Note. Data on elongation per unit length, relative reduction of area and impact toughness are given for forgings with different sizes/dimensions according to diameter and thickness (GOST 8479-70).

Key: (1). Designation of parts. (2). Trademark of steel. (3). Category of strength. (4). Mechanical properties. (5). kg/cm². (6). kg·m/cm². (7). Shaped parts. (8). Flanges transitional and under

thermometers; silencer/plug. (9). Flanges (transitional, silencers/plugs). (10). Flanges under thermometers. (11). Intricately-shaped parts. (12). Shaped parts, flanges transitional, silencers/plugs. (13). Then. (14). flanges under thermometers. (15). Shaped parts, flanges transitional, silencers/plugs.

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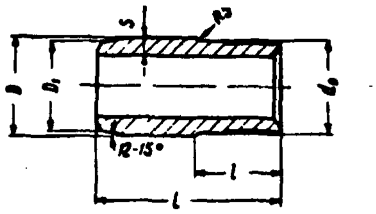
Table 12. Connecting pipe on P_y from 200 to 500 kg/cm² (НИ 4971-63).



(1) Исполнение	(2) Размеры в мм							(3) Масса в кг
	D_y	D	D_1	d_0	S	L	l	
II	6	18	13	M14×1,5	4,5	100	32	0,11
II	10	25	21	M24×2	7			0,2[illegible]
II	15	35	26	M33×2	9	110	42	0,6
I	25	45	38	M42×2				0,8[illegible]
II								0,8[illegible]
I	32	50	46	M48×2			45	0,96
II								0,96
I	40	68	58	M64×3	12	130	60	2,1
II								2,1
I	60	83	78	M80×3	14	160	65	3,8
I	70	102	90	M100×3	16	180	75	5,9

Notes: 1. Performance and materials - see Table 2 and 3.

2. Ends connecting threading - see Table 8.

3. Dressing of weld grooves - according to MRTU 26-01-9-67.

4. Connecting pipe they prepare from ducts or forgings.

5. Ducts - according to TSPM VNITI 518-63 and TSPM VNTII 3-248-69.

Key: (1). Performance. (2). Sizes/dimensions in mm. (3). Mass in kg.

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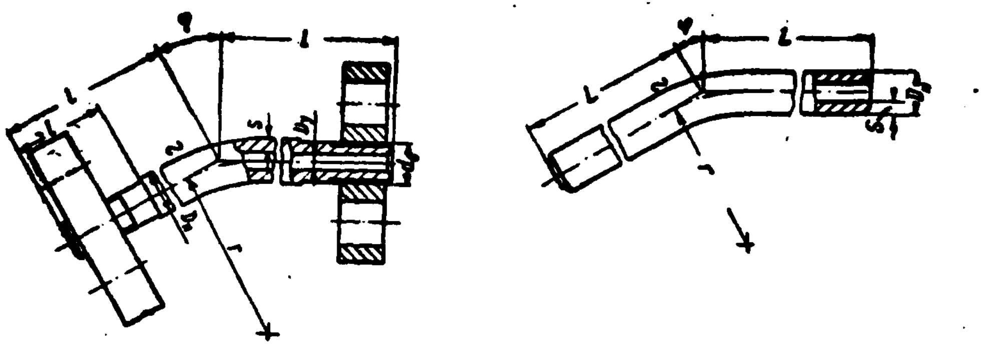
Table 13.

Curved elbows for P_y from 200 to 1000 kg/cm^2 (MN 4972-63 and MN 4998-63).



(1) Испол-нение	(2) Размеры в мм					(3) развернутая длина в мм	φ=90° (4) масса в кг	
	D_y	$D_н$	S	L	r		(5) без фланцев	(6) с фланцами
II	6	12	3	130	55	236	0,16	—
IV		15	4,5				0,28	1
II	10	20	4,5	180	90	321	0,55	—
IV		25	7				1	2,86
II	15	25	5			386	0,79	—
IV		35	9	220	125		2,23	4,93
I	25	35	5			527	1,43	—
II		45	9	300	170		4,21	7,33
III		45	10				4,55	7,67
IV		50	12	360	225	624	7,02	11,67
I	32	45	6,5				3,9	—
II		50	9				5,67	10,9
III		57	12	400	280	688	9,38	18,2
IV		68	16	460	275	780	16	24,5

I	40	57	7	400	[illegible]	[illegible]	6	—
II		[illegible]	12	400	275	700	12,9	21,4
III			14				14,5	22
IV		83	19	560	340	974	29,2	42,3
I	60	76	9				14,5	—
II		83	14				23,2	37,3
III		102	20	680	450	1167	47,2	68,1
IV			22				50,7	71,6
I	70	89	11	680	450	1167	24,7	—
II		102	16				39,6	60,8
III		114	22	740	480	1276	63,7	91,7
IV		127	28	800	525	1378	94,2	124
I	90	114	14	740	480	1276	44,1	72,1
II		127	18	800	525	1378	66,7	96,7
III		140	25	900	600	1542	109	155
IV		159	36	1000	630	1729	189	235
I	100	127	14	800	525	1378	53,8	84,1
II		140	20	900	600	1542	91,3	137
III		159	28	1000	630	1729	156	202
IV		180	40	1120	710	1934	267	330
I	125	159	18	1000	630	1729	108	154
II		180	28	1120	710	1934	203	266
III		194	36	1300	800	2266	316	427
IV		219	46	1400	900	2413	[illegible]	[illegible]

I	150	194	20	1200	800	2286	188	302
II		219	32	1400	900	2413	386	460
III		245	45	1550	1120	2618	581	750
IV		273	60				825	1037
I	300	245	25				355	524
II		273	38				577	780
III		290	50	1800	1250	3063	940	1269

Notes: 1. The groups of steel, saturated conventional pressures and materials - see Table 1, 2 and 3.

2. Size/dimension d_0 for appropriate $D_н$ - see Table 8.

3. Sign "-" in graph/count "mass with flanges" means that for this performance offtakes are prepared only with ends under weld.

4. Mass of offtakes under weld is equal to mass of offtakes without flanges.

5. Mass of offtakes without flanges is determined with

trademarks of steel with a density of 7.85; for trademarks of steels of group KhN density to accept on Table 10, chapter 1.

6. Ends connecting and flanges threading - see Table 8.

7. Dressing of weld grooves - according to MRTU 26-01-9-67.

Key: (1). Performance. (2). Sizes/dimensions in mm. (3). expanded/scanned length in mm. (4). mass in kg. (5). without flanges. (6). with flanges.

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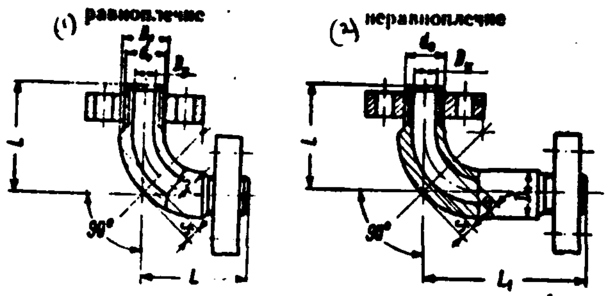
Table 14. Elbows at angle of 90° with flanges on P_y from 200 to 1000 kg/cm² (according to MN 4973-63, MN 4975-63).



(5) Исполнение	(3) Размеры в мм							(4) Масса колена в кг			
	D_y	$D_н$	d_0	S (6) не менее в мм	S_1	L	L_1	(8) без фланца: (9) равноплечего	(10) неравноплечего	(7) с фланцами: (9) равноплечего	(10) неравноплечего
II	6	18	M14×1,5	4,5	4,5	60	110	0,16	0,25	0,88	0,97
IV		20		6,5	6			0,2	0,31	0,92	1,03
II	10	28	M24×2	6	6	85	140	0,59	0,82	2,45	2,68
IV		32		8,5	8,5			0,73	1,06	2,59	2,91
II	15	36	M33×2	7	7	95	150	1,05	1,41	3,75	4,11
IV		40		11	9,5			1,26	1,72	3,96	4,42
III	25	50	M42×2		10	110	165	2	2,64	5,12	5,76
IV		60	M48×2	16	14	120	185	3,41	4,6	8,61	9,8
II	32			11	10			2,9	3,93	8,1	9,13
III		65	M56×3	14	13	150	235	4,76	6,43	13,8	15,4
IV		75	M64×3	19	17			6,58	8,93	15,1	17,4
II	40	70		13	12			4,98	6,7	13,6	16,2
III		78		16	15			5,85	7,96	14,4	16,5

IV	60	100	M80×3	26	22	170	270	13,4	18,5	27,5	32,5
II				17	18			11,1	15,4	25,2	29,5
IV		115	M100×3	28	24	200	325	18,7	26,1	39,7	47,1
II				19	17			16	22,4	37	43,4
III	70	125	M110×3	25	21	236	370	24,8	33,7	52,9	61,8
IV		140	M125×4	34	28			34	46,2	64	76,2
I	90	125	M110×3	16	16			19	26	47	54
II		140	M125×4	21	21			26,1	37,7	56,1	67,7
III		150	M135×4	30	26	290	460	41,8	57,9	64,6	104
IV		170	M155×4	43	34	290	460	65,5	88	112	134
I	100	140	M125×4	18	17	236	370	21,4	29,4	51,4	59
II		160	M135×4	26	23	290	460	43,4	59,7	89	106
III		170	M155×4	34	28			57	76,8	103,4	123
IV		190	M175×6	48	37			75,3	103	139	166
I	125	170	M155×4	20	18	290	460	43,5	58,7	89,9	105
II		190	M175×6	31	25			61,9	84,6	125	148
III		205	M190×6	37	33	480	580	134,7	151,7	262	262,2
IV		240	M215×6	63	50			203	229	314	341
I	150	205	M190×6	23	23			93,7	106	204	216
II		230	M215×6	34	32			147	165	256	277
III		255	M240×6	45	41	600	700	236	262	405	431
IV		290	M265×6	66	57			358	396	570	608
I	200	265	M240×6	26	28			122	139	291	308
II		290	M265×6	41	38			244	271	436	483
III		315	M295×6	56	48	680	780	402	439	731	767

notes: 1. The groups of steel, saturated conventional pressures and materials - see Table 1, 2 and 3.

2. Ends connecting and flanges threading - see Table 8.

Key: (1). isoceles. (2). Unequal-arm. (3). Sizes/dimensions in mm. (4). Mass of elbow in kg. (5). Performance. (6). without flange. (7). with flanges. (8). it is not less in mm. (9). isoceles. (10). Unequal-arm.

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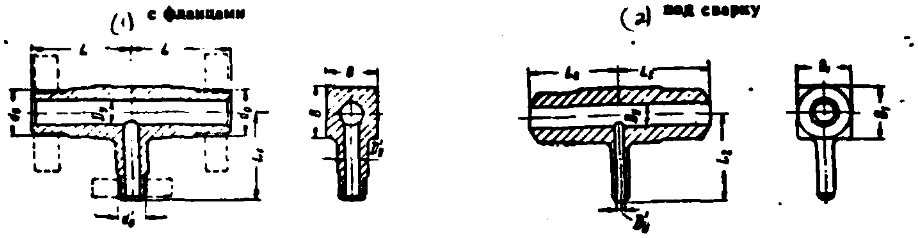
Table 15.

Transition T-pieces for Py from 200 to 1000 kg/cm^2 (MN 4981-63, MN 5004-63).



(3) Исполнение	(4) Размеры в мм								(5) Масса тройников в кг	
	$D_y \times D_y$	d_0	d_0'	L	L_1	L_2	B	B_1	(6) с фланцами	(7) под сварку
II	6×6	M14×1,5	M14×1,5	60	60	60	18	18	1,35	0,23
IV							20	30	1,34	0,33
II	10×6	M24×2		85	85	70	28	25	2,83	0,45
IV						75	30	30	2,99	0,73
II	10×10		M24×2			70	28	35	3,88	0,82
IV						75	30	30	3,71	0,81
II	15×6	M33×2	M14×1,5	95	85	75	35	30	3,97	0,63
IV						85.	40	40	4,47	1,42
II	15×10		M24×2			75	35	30	4,66	0,66
IV						85	40	40	5,16	1,52
II	15×15		M33×2		95	75	35	30	5	0,67
IV						85	40	45	5,75	1,7
I	25×6	—	—	—	—	85	—	45	—	1,9
II		M42×2	M14×1,5	110	85	—	45	55	5,38	2,9
II		—	—	—	—	85	—	45	—	1,39
III		M42×2	M14×1,5	110	85	100	50	55	5,44	2,97
IV		M48×2		120	95	100	60	60	9,47	3,78
I	25×15	—	—	—	—	85	—	45	—	2

II	25×15	M42×2	M33×2	110	95	—	45	55	6,5	2,45
II		—	—	—	—	85	—	45	—	3
III		M42×2	M33×2	110	95	100	50	55	6,75	3,23
IV		M48×2		120	110	100	60	60	11,2	4,03
I	25×25	—	—	—	—	85	—	45	—	2,04
II		M42×2	M42×2	110	110	85	45		7,05	2,36
III						100	50	55	7,05	3,42
IV		M48×2	M48×2	120	120	100	60	60	12,6	4,46
I	32×25	—	—	—	—	100	—	55	—	2,63
II		M48×2	M42×2	120	110		60	60	10,4	3,78
		—	—	—	—		—		—	2,97
III		M56×3	M42×2	150	120	110	65	65	16,7	5,35
IV	32×25	M64×3	M48×2	150	120	110	75	75	20	7,26
I	32×32	—	—	—	—	100	—	55	—	2,63
II		M48×2	M48×2	120	120		60	60	11,8	3,87
III		M56×3	M56×3	150	150	110	65	65	20,8	6,1
IV		M64×3	M64×3				75	75	22,8	8
I	40×25	—	—	—	—	110	—	65	—	4,25
II		M64×3	M42×2	150	110		70	70	16,5	4,8
III							75	75	18,9	6,69
IV		M80×3	M48×2	170	150	150	90	90	30	13,5
I	40×40	—	—	—	—	110	—	65	—	4,85
II		M64×3	M64×3	150	150	110	70	70	20,2	11,2
III							75	75	22	7,44

IV	40×40	M80×3	M80×3	170	170	150	90	90	36,4	17,6
I	60×40	—	—	—	—	—	—	85	—	8,94
II		M80×3	M64×3	170	150	150	90	90	29,9	12,4
		—	—	—	—	—	—		—	11,6
III		M100×3	M64×3	200	170	170	115	115	49,7	24
IV			M80×3						55	25,3
I	60×60	—	—	—	—	150	—	85	-	9,28
II		M80×3	M80×3	170	170		90	90	35,7	15,1
IV		M100×3	M100×3	200	200	170	115	115	60,8	26,5
I		—	—	—	—	170	—	100	—	14
II		M100×3	M64×3	200	170		115	115	47,6	21,4
II		—	—	—			—		—	20,6
III	70×40	M110×3	M64×3	235	215	190	125	125	66,5	30,9
IV		M125×4	M80×3				140	140	84	42,5
I	70×70	—	—	—	—	170	—	100	—	14,9
II		M100×3	M100×3	200	200		115	115	56,3	22,9
III		M110×3	M110×3	235	235	190	125	125	80,9	34,3
IV		M125×4	M125×4				140	140	100,3	46,9
I	90×60	M110×3	M80×3	235	215	190	125	125	61,6	24,1
II		M125×4					140	140	75,2	34,3
III		M135×4	M100×3	290	235	235	155	155	123	60,5
IV		M155×4					170	170	148	79,1
I	90×90	M110×3	M110×3	235	235	190	125	125	74,8	36
II		M125×4	M125×4				140	140	87,6	36,9

III	90×90	M135×4	M135×4	290	290	235	155	155	141	65,3
IV		M155×4	M155×4				170	170	173	80,8
I	100×70	M125×4	M100×3	235	235	190	140	140	74,7	29,2
II		M135×4				235	155	155	115	52,8
III		M155×4	M110×3	290			170	170	139	69,5
IV		M175×6	M125×4			250	190	190	190	104
I	100×100	M125×4	M125×4	235	235	190	140	140	80,2	31
II		M135×4	M135×4	290	290	235	155	155	137	56
III		M155×4	M155×4				170	170	158	73,5
IV		M175×6	M175×6			250	190	190	221	113
I	125×90	M155×4	M110×3		235	235	170	170	121	53,8
II		M175×6	M125×4			250	190	190	163	79,8
III	125×90	M190×6	M135×4	360	290	285	210	210	294	133
IV		M215×6	M155×4				240	240	351	189
I	125×125	M155×4	M155×4	290	290	235	170	170	127	57,2
II		M175×6	M175×6			250	190	190	188	84,6
III		M190×6	M190×6	360	360	285	210	210	337	143
IV		M215×6	M215×6				240	240	411	202
I	150×100	M190×6	M125×4	360	290	285	210	210	233	96
II		M215×6	M135×4				240	240	303	143
III		M240×6	M155×4	435	360	320	270	270	487	249
IV		M265×6	M175×6				300	300	634	331
I	150×150	M190×6	M190×6	360	360	285	210	210	285	103
II		M215×6	M215×6				240	240	345	154

III	150×150	M240×6	M240×6	435	435	320	270	270	[illegible]	[illegible]
IV		M265×6	M265×6				300	300	788	352
I	200×150	M240×6	M190×6	435	360	320	270	270	436	395
II		M265×6	M215×6				300	300	567	411
III		M295×6	M240×6	520	460	390	320	320	946	402
I	200×200	M240×6		435	435	320	270	270	482	412
II		M265×6	M263×6				300	300	640	430
III		M295×6	M295×6	530	[illegible]	390	[illegible]	380	[illegible]	441

Notes: 1. The groups of steel, saturated conditional pressures and materials - see Table 1, 2 and 3.

2. Ends connecting and flanges threading - see Table 8.

3. Dressing of weld grooves - according to MRTU 26-01-9-67.

4. Sign "-" in graph/count "mass with flanges" means that for this performance T-connections are prepared only with ends under weld.

Key: (1). with flanges. (2). under weld. (3). Performance. (4). Sizes/dimensions in mm. (5). Mass it is branch in kg. (6). with flanges. (7). under weld.

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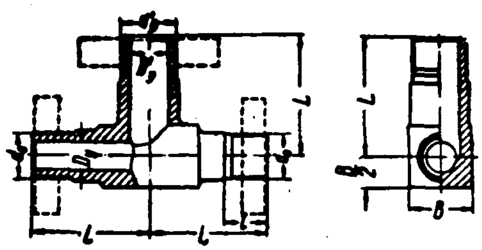
Table 16. T-connections transitional with flanges on P_y from 200 to 1000 kg/cm² (MN 4984)*.



(3) Испол-нение	(1) Размеры в мм					(2) Масса в кг	
	$D_y \times D_y'$	d_0	d_0'	L	B	(4) без фланцев	(5) с фланцами
II	40×60	M64×3	M80×3	170	90	9,44	25
III			M100×3	200	115	15,6	31,1
IV		M80×3				17,9	42,4
II	60×70					14,2	38,8
III		M100×3	M110×3	235	125	27,7	62,7
IV			M125×4		140	30,4	76,4
I	70×90		M110×3		125	21,9	57
II			M125×4	290	140	24,3	60,3
III		M110×3	M135×4		155	39,8	90,3
IV		M125×4	M155×4		170	58,9	112
I	90×100	M110×3	M125×4	235	140	21,5	64,6
II		M125×4	M135×4	290	155	39,4	92,7
III		M135×4	M155×4		170	56,1	125
IV		M155×4	M175×6		190	83,1	161
I	90×125	M110×3	M155×4		170	28,9	80,2
II		M125×4	M175×6		190	44,4	106
III		M135×4	M190×6	380	210	79,3	180
IV		M155×4	M125×6		240	116	218

I	100×125	M125×4	M155×4	290	170	37,6	99,8
II		M135×4	M175×6		190	40,2	127,5
III		M155×4	M190×6	360	210	91,2	199
IV		M175×6	M215×6		240	135,3	254
I	125×150	M155×4	M190×6		210	61,9	165
II		M175×6	M215×6		240	93	212
III		M190×6	M240×6	435	270	174	369
IV		M215×6	M265×6		300	254	471
I	150×200	M190×6	M240×6		270	112	307
II		M215×6	M265×6		300	176	[illegible]
III		M240×6	M295×6	520	330	313,2	648

Note. See note to table 15.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg. (3). Performance. (4). without flanges. (5). with flanges.

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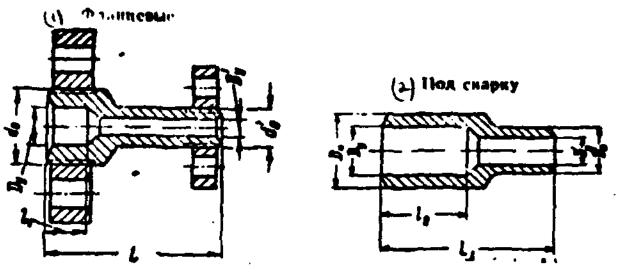
Table 17. Transitions point on P_y from 200 to 1000 kg/cm² (MN 4986-63 and MN 5008-63).



(3) Исполнение	(4) Размеры в мм								(5) Масса перехода в кг	
	$D_y \times D_y'$	$D_н$	$D_н'$	d_0	d_0'	L	l_1	l_2	(6) с фланцами	(7) под сварку
II	10×6	21	13	—	—	110	—	45	—	0,18
IV		26	15	M24×2	M14×1,5	100	20		1,48	0,27

II	15×10	26	21	M33×2	M24×2	110	30	45	2,43	0,26
IV		26	26	M33×2	M24×2	110			2,[illegible]	0,46
I	25×15	38		—	—	—	—		—	0,34
II		46		M42×2	M33×2	120	30		3,18	0,63
		38		—	—	—	—		—	0,42
III		46	36	M42×2	M33×2	120	30		3,43	0,8
IV		50	36	M48×2	M33×2	130			4,86	0,99
I	32×15	46	26	—	—	—	—		—	0,51
II		50		M48×2	M33×2	130	30		4,54	0,7
III		58	36	M56×3		150	35	40	7,29	1,18
IV		70		M64×3					7,1	1,53
I	32×25	46	38	—	—	—	—	45	—	0,57
II		50	46	M48×2	M42×2	130	30		5,03	1,23
			38	—	—	—	—		—	1,05
III		58	46	M56×3	M42×2	150	35		7,37	1,36
IV		70	50	M64×3	M48×2				8,91	1,9
I	40×25	58	38	—	—	—	—	75	—	1,33
II		62							—	1,7
III		70	46	M64×3	M42×2	150	35		7,29	2,36
IV		85	50	M80×3	M48×2	170			12,3	3,64
I	40×32	58	46	—	—	—	—	75	—	1,51
II		70	50	M64×3	M48×2	150	35		8,61	2,45
		62		—	—	—	—		—	1,84
I	60×32	70	46	—	—	—	—		—	1,91
II		85	50	M80×3	M48×2	170	35		11,7	2,96

Note. 1. See notes to Table 15.

2. For transitions under weld for all performances $D_y \times D_y$ 10x6 to 32x25 mm L_1=110 mm and from 40x25 to 60x32 inclusively L_1=150 mm.

Key: (1). Flanged. (2). under weld. (3). Performance. (4). Sizes/dimensions in mm. (5). Mass of transition in kg. (6). with flanges. (7). under weld.

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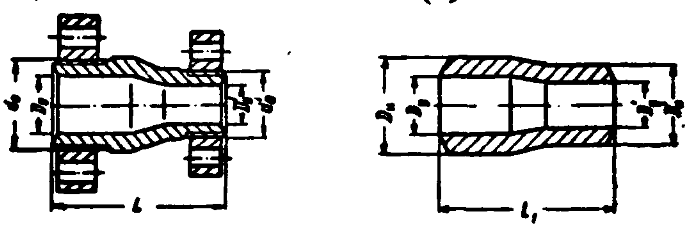
Table 18. Transitions stamped/die-forged on p_y from 200 to 1000 kg/cm² (MN 4987-63 and MN 5009-63)[1].

FOOTNOTE [1]. See notes to Table 15. ENDFOOTNOTE.

(1) Фланцевые (2) Под сварку



(3) Исполнение	(4) Размеры в мм $D_y \times D_y$	$D_н$	$D'_н$	d_0	d'_0	L	L_1	(5) Масса перехода в кг (6) фланцевого	(7) под сварку
III	40×32	68	57	M64×3	M56×3	190	126	11,6	2,1
IV		83	68	M80×3	M64×3		170	15,9	4,94
III	60×32	102	57	M100×3	M56×3			19,9	5,8
IV			68		M64×3			20,5	5,45
I	60×40	76	57	—	—	—		—	2,6
II		83	68	M80×3	M64×3	190		14,5	3,96
			60	—	—	—		—	3,52
III		102	68	M100×3	M64×3	190		20,1	6
IV			83		M80×3	220	190	24,8	7,26
I	70×50	89	57	—	—	—	170	—	3,17
II		102	68	M100×3	M64×3	190		19,2	5
			60	—	—	—		—	4,7
III		114	68	M110×3	M64×3	220		25,2	7
IV		127	83	M125×4	M80×3		220	32,6	12,3
I	90×60	114	76	M110×3	M80×3	220	220	26,7	6,54
II		127	83	M125×4				29,1	8,96
III		140	102	M135×4	M100×3	270		48,4	13,6
IV		160		M155×4				64,3	18,5

Continuation Table 18.

I	100×70	127	[illegible]	M[illegible]×4	M100×3	240	220	34	7
II		140	108	M130×4		270		45,7	10,8
III		159	114	M155×4	M110×3	300	240	57,1	18,2
IV		168	127	M175×6	M125×4			77,3	27
I	125×90	159	114	M155×4	M110×3	300	240	51,2	13,3
II		180	127	M175×6	M125×4			67,4	21,1
III		194	140	M190×6	M135×4	340	270	113	32,7
IV		219	159	M215×6	M155×4			132	46,3
I	150×100	194	127	M190×6	M125×4	340	270	91,3	19,7
II		219	140	M215×6	M135×4		300	110	39,7
III		245	159	M240×6	M155×4	430	300	175	57
IV		273	180	M265×6	M175×6			230	76
I	200×150	245	194	M240×6	M190×6		270	185	31,7
II		273	219	M265×6	M215×6		300	233	57,7
III		[illegible]	245	M[illegible]×6	M240×6		270	[illegible]	76,7

Key: (1). Flanged. (2). Under weld. (3). Performance. (4). Sizes/dimensions in mm. (5). Mass of transition in kg. (6). flanged. (7). under weld.

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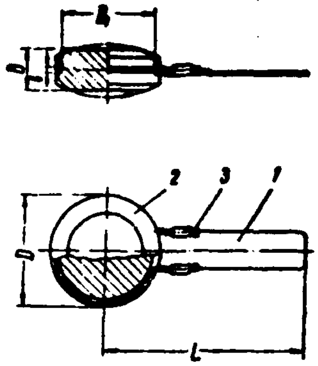
Table 19. Lens deaf with indicator on P_y from 200 to 1000 kg/cm² (MN 4970-63).



(1) Исполнение	(2) Размеры в мм D_y	D	D_1	L	B	b	(3) Масса в кг
IV	6	14	11	60	8,5	1,6	0,014
IV	10	22	19	75	10		0,036
IV	15	30	26	90	11	2,2	0,066
IV	25	44	40	100	14		0,159
IV	32	60	56	130	18		0,345
II	40	65	60	150		2,8	0,421
IV					30		0,731
II	60	82	76	190	30	3,4	0,82
IV					32		1,32
II	70	100	94	220	25		1,45
IV					[illegible]		[illegible]
II	[illegible]	125	118	[illegible]	[illegible]	4,1	2,72
IV					42		[illegible]
II	100	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
IV					45		[illegible]
II	125	175	168	310	36	4,4	5,92
IV					45		7,81
II	180	210	202	350	40	4,4	9,52
IV					60		15
II	[illegible]	270	[illegible]	[illegible]	45		17,6
III					[illegible]		24,3

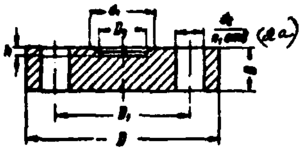
Note. The material of lens (parts 2) - see Table 3.

Key: (1). Performance. (2). Sizes/dimensions in mm. (3). Mass in kg.

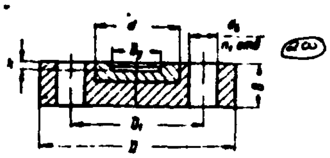
Pages 221-222.

Table 20. Silencers/plugs on P_y from 200 to 1000 kg/cm².

(1) Заглушки без вставки (МН 4996-63)



(2) Заглушка с вставкой (МН 4996-63)



<table>
<tr><th rowspan="2">(3) Исполнение</th><th colspan="6">(4) Размеры в мм</th><th colspan="2">(5) Масса заглушки в кг</th></tr>
<tr><th>D_y</th><th>D</th><th>B</th><th>d_1</th><th>h</th><th>d</th><th>(6) без вставки</th><th>(7) с вставкой</th></tr>
<tr><td>II</td><td rowspan="2">6</td><td rowspan="2">70</td><td rowspan="2">15</td><td rowspan="2">10</td><td rowspan="2">3</td><td>15</td><td>—</td><td>0,38</td></tr>
<tr><td>IV</td><td>—</td><td>0,4</td><td>—</td></tr>
<tr><td>II</td><td rowspan="2">10</td><td rowspan="2">95</td><td rowspan="3">20</td><td rowspan="2">18</td><td rowspan="5">4</td><td>25</td><td>—</td><td>0,99</td></tr>
<tr><td>IV</td><td>—</td><td>1</td><td>—</td></tr>
<tr><td>II</td><td rowspan="2">15</td><td rowspan="2">105</td><td rowspan="2">28</td><td>35</td><td>1,2</td><td>1,23</td></tr>
<tr><td>IV</td><td>25</td><td>—</td><td>1,6</td><td>—</td></tr>
<tr><td>II</td><td rowspan="3">25</td><td rowspan="2">115</td><td rowspan="2">25</td><td rowspan="2">37</td><td>45</td><td>—</td><td>1,83</td></tr>
<tr><td>III</td><td rowspan="2">5</td><td>—</td><td>1,6</td><td>—</td></tr>
<tr><td>IV</td><td>138</td><td>30</td><td>40</td><td>—</td><td>2,8</td><td>—</td></tr>
</table>

Continuation Table 20.

II	32	135	30	40	5	80	2,5	2,90
III		165	35	48		—	5	—
IV				56	6	—	5	—
II	40			55	5	70	—	5,00
III						—	5	—
IV		200	40	65	6	—	8,5	—
II	60			72		85	8,5	8,5
IV		225	50	82		—	13,4	—
II	70			90	7	106	13,4	13,4
III	70	245	55	95		—	17,9	—
IV		260				—	20,1	—
I	90	245	55	100	8	115	17,7	15,9
II		260		115		125	19,9	17,9
III		290	65			—	26,6	—
IV		300	70	120		—	33,2	—
I	100	260	55	115		125	19,8	19,9
II		290	65	125		140	29,9	29,6
III		300	70	132		—	33,1	—
IV		330	80			—	46,2	—
I	125	300	70	145	10	160	32,6	32,7
II		330	80	162		180	45,7	45,8
III		400	85			—	73,2	—
IV			95	165		—	81,9	—
I	150		85	175	11	195	73,8	72,3
II			95	195		220	81,3	81,1

Continuation Table 20.

III	[illegible]	400	105	195		—	119	—
IV		400	120			—	161	—
I	[illegible]	400	105	225	12	246	118	118
II		400	120	245		—	159	—
II		570				—	254	—

Notes: 1. The groups of steel, saturated conventional pressures and materials - see Table 1, 2 and 3.

2. Sizes/dimensions D_1, d_2 - see Table 8.

3. Insert in silencer/plug MN 4996-63 - see Table 21.

Key: (1). Silencers/plugs without insert (MN 4995-63). (2). Silencer/plug with insert (MN 4966-63). (2a). opening. (3). Performance. (4). Sizes/dimensions in mm. (5). Mass of silencer/plug in kg. (6). without insert. (7). with insert.

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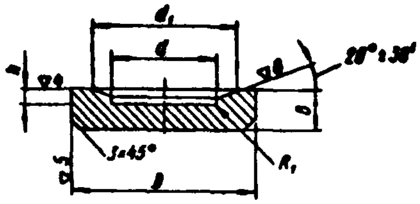
Table 21. Insert to silencer/plug on P_y = 200 and 320 kg/cm² (MN 4996-63).



(1) Исполнение	(2) P_y, кгс/см²	(3) Размеры в мм D_y	D	d	d_1	B	h	(4) Масса в кг
II	320	6	15	6	10	8	3	0,01
II		10	25	10	18	10	4	0,01
II		15	35	15	28	12		0,08
II		25	45	25	37			0,14
II		32	50	32	43	15	5	0,2
II		40	70	40	55			0,11
II		60	85	60	72	20	6	0,76
II		70	105	70	90		7	1,16
I	200	90	115	90	100	25	8	1,06
II	320		125		115			2,03
I	200	100		100				1,98
II	320		140		125			2,56
I	200	125	160	125	145	30	10	3,82
II	320		180		162			5,09
I	200	150	195	150	175	35	11	6,77
II	320		220		195			9,04
I	200	200	245	200	225	40	12	11,80

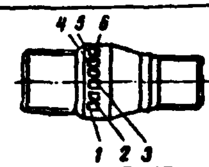
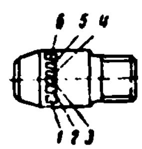
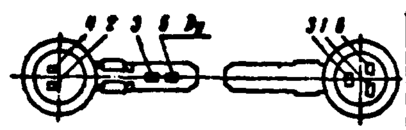
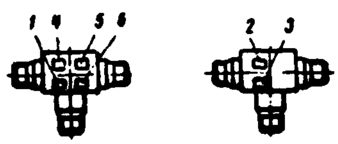
Note. Material - steel of the brands/marks of Kh18N10T, Kh17N13M3T - see Table 3 and 11.

Key: (1). Performance. (2). kg/cm². (3). Sizes/dimensions in mm. (4). Mass in kg.

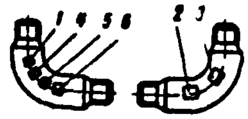
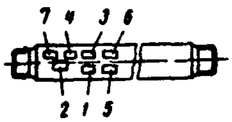
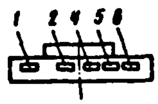
Pages 224-225.

Table 22. Arrangements of the places of marking on the parts of conduits/manifolds (MN 5010-63).

1 - brand of the manufacturing plant; 2 - brand/mark of steel; 3 - conventional pressure; 4 - number of the batch; 5 - parts number; 6 - mark of the final inspection/acceptance; 7 - OTK of plant - the producer of ducts.

(1) Наименование деталей	(2) Расположение клейм
(3) Переходы	
(4) Штуцера	
(5) Линзы глухие	
(6) Тройники, угольники, тройники-вставки	

Continuation Table 22.

(7) Отводы линзовые	
(8) Колена, отводы	
(9) Трубы	
(10) Фланцы переходные, заглушки, специальные фланцы	
(11) Карманы для термопары	(12) Клейма располагают на цилиндрической поверхности линзового уплотнения в следующем порядке: 1) завод-изготовитель; 2) марка стали; 3) номер партии; 4) номер детали.

Key: (1). Designation of parts. (2). Arrangement of marks. (3). Transitions. (4). Connecting pipe. (5). Lens (deaf. (6). T-connections, angle plates, T-connection-inserts. (7). Offtakes (lens. (8). Elbows, offtakes. (9). Ducts. (10). Flanges transitional, silencers/plugs, special flanges. (11). Karmans for thermocouple. (12). Marks furnish on cylindrical surface of lens packing/seal in following order: 1) manufacturing plant; 2) trademark of steel; 3) number of batch; 4) parts number.

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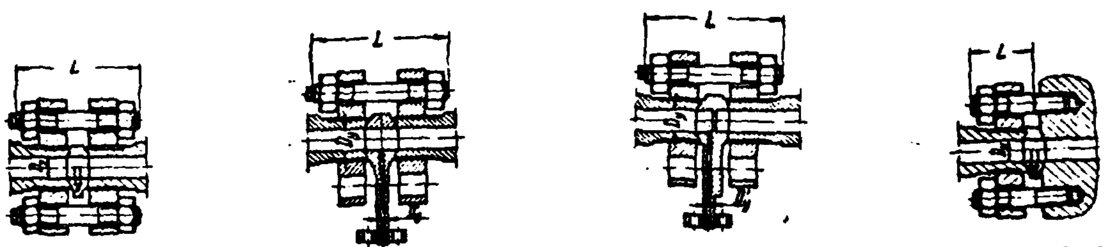
Table 23. Types of the flange joints of conduits/manifolds on P_y to 1000 kg/cm² and the selection of the lengths of pins.

1 2 3 4



(1) Проход условный D_y	(2) Исполнение	(3) Диаметр шпильки	(4) Длина двусторонней шпильки L в мм при: (5) линзе жесткой	(6) линзе компенсирующей	(7) отводе линзовом: D_y=6÷10	(7) отводе линзовом: D_y=15	(8) диафрагме	(9) Длина шпильки ввертной L в мм при: (5) линзе жесткой	(6) линзе компенсирующей
			(10) тип 1		(11) тип 2		(10) тип 3	(12) тип 4	
6	II и IV	M14	80	—	105	—	100	40	—
10	II и IV	M16	95		125	—	120	45	—
15	II				120	130	115	45	—
	IV		105		—	—	125	50	—
25	II	M16	105	—	130	140	130	55	—
	III					—			
	IV	M20	125		150		150	60	—
32	II		130			160		70	—
	III и IV	M22	145		165	—	165	75	—
40	II			150			170		80
	III		155	155	170			85	85
	IV	M27	175	175	190		190	90	90
50	II		170		195	205	210	85	95
	III и IV	M30	205	205	220	230	220	110	110
70	II		195	200			235	100	105
	III		215	215	230	240	245	115	115
	IV	M33	225	225	235	245	280	120	120

Continuation Table 23.

90	I	M30	215	230	235	245	260	115	120
	II	M33	220		240	250			
	III	M36	260	260	270	280	290	140	140
	IV		270	270	280	290	300		
100	I	M33	220	225	245	255	265	130	130
	II	M33	215	250	270	280	290		125
	III		270	270	280	290	300	145	145
	IV	M39	300	300	310	320	330	—	—
125	I	M36	265	265	290	300	310	—	—
	II	M39	290	290	310	320	330	—	—
	III	M45	320	330	340	350	360	—	—
	IV		340	340	360	370	380	—	—
150	I	M45	320	330	340	360	370	—	—
	II		330	340	360	370	380	—	—
	III	M52	400	400	400	410	420	—	—
	IV	M56	450	450	460	470	480	—	—
200	I	M52	390	390	410	420	430	—	—
	II	M56	450	450	460	470	480	—	—
	III								

Note. The size/dimension of 105 mm for flange joint of type 2 is given only for D_y-6

Key: (1). Pass is conventional. (2). Performance. (3). Diameter of pin. (4). Length of two-sided pin L in mm with. (5). to lens of rigid. (6). to lens of that compensating for. (7). offtake (lens. (8). to diaphragm. (10). type.

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Table 24. Mechanical properties of the parts of the flange joints of conduits/manifolds on p_y from 200 to 1000 kg/cm².

(1) Наименование деталей	(2) Марка стали	ГОСТ (3)	Категория прочности (ГОСТ 8479—70)	$\sigma_в$	$\sigma_т$	δ_5	ψ	a_k, кгс·м/см² (6)	НВ
				(4) кгс/мм²		(5) %, не менее			
(7) Фланцы резьбовые, ГОСТ 9399—63: (8) при $b<35$ мм » $b>35$ » » $b<95$ »	35 30Х 38ХА, 40Х 25Х2МФА	1050—60* (9) 4543—71 4543—71 По утвержденным техническим условиям	КП28 КП40А КП63А	56 63 85	28 40 63	12—18 14—17 11—13	30—40 40—45 38—42	3—4 5—6 5,5—6,5	156—197 187—229 248—293
» $b>95$ мм	38ХА, 40Х 25Х2МФА	4543—71 (9) По утвержденным техническим условиям	КП60А	80	60	11—14	40—45	5,5—6,5	235—277
(10) Шпильки уплотнительные, ГОСТ 10493—63	20 18ХГ Х3МВ	1050—60 4543—71 10493—63	КП22 КП32 КП45А	44 62 65	22 32 45	16—22 11—16 13—16	35—53 30—38 40—45	3,5—5,5 3—3,5 5—6	123—167 174—217 197—235
(11) Шпильки двусторонние, ГОСТ 10494—63	35ХГ2 40ХФА 25Х2МФА	4543—71 4543—71 (9) По утвержденным техническим условиям	— — —	70 80 85	50 65 70	18 18 15	— — —	8 6 8	197—255 235—285 255—302
(12) Гайки чистые, ГОСТ 10495—63	30Х 35Х 30ХМА	4543—71 4543—71 4543—71	— — —	65 75 80	45 57 65	15 15 15	— — —	6 6 6	183—234 217—263 229—277

Notes; 1. b - thickness of flange.

2. Data on elongation per unit length, relative reduction of area and impact toughness for flanges and lens are given for forgings with different sizes/dimensions according to diameter and thickness.

Key: (1). Designation of parts. (2). Trademark of steel. (3). Category of strength. (4). kg/mm². (5). it is not less. (6). kgf•m/cm². (7). Flanges (threading. (8). with. (9). According to

affirmed technical specifications. (10). Pins (packing. (11). Pins (two-sided. (12). Nuts (pure/clean.

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4. Parts of flange joints.

The parts of flange joints with lens packing/seal are intended for connections with flanges on the thread of fittings, connecting pieces and ducts on P_y from 200 to 1000 kg/cm^2 and $D_y=6\div200$ мм.

The parts of flange joints supply on the following standards:

ends the connecting threading for the elements/cells of conduits/manifolds under lens packing/seal - GOST 9400-63 and flanges steel threading - GOST 9399-63 (Table 8);

lens packing rigid and compensating for - GOST 10493-63 (Table 25, 26 and 27);

pins two-sided - GOST 10494-63 (Table 28, 29 and 30);

nuts pure/clean hexahedral - GOST 10495-63 (Table 31).

The materials, used for flange joints, are given in Table 3.

The types of flange joints on MN 5010-63 are given in Table 23.

Flanges and lens prepare from forgings, stampings or rolled stock with the observance of the required categories of strength.

Is allowed/assumed the manufacture of lens from the thick-walled ducts which are subjected for this purpose to heat treatment to the lowered/reduced in comparison with ducts hardness.

The mechanical properties of the parts of flange joints in the heat-treated state at temperature of 20°C must correspond to those indicated in Table 24.

Table 25. Types and performances or the lens of packing ones on P_y from 200 to 1000 kg/cm² (GOST 10493-63).

(1) Наименование	(2) Обозначение	
	(3) типов	(4) исполнений
(5) Линза жесткая без бурта	Ж	ЖI
(6) То же, с буртом		ЖII
(7) Линза компенсирующая при давлении до P_y 500 кгс/см²	К	КI
(8) То же, при давлении P_y = 610 ÷ 1000 кгс/см²		КII

Key: (1). Designation. (2). Designation. (3). types. (4). performances. (5). Lens rigid without collar. (6). Then, with collar. (7). Lens compensating for with pressure to P_y 500 kg/cm². (8). Then, at pressure P_y = 610÷1000 by kg/cm².

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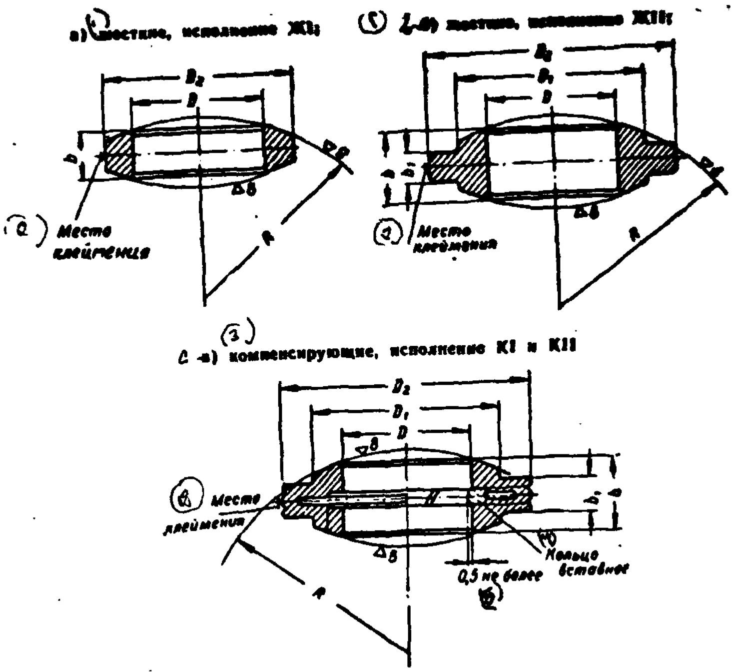
Lens rigid use at temperatures to 400°C (for the I and II temperature steps/stages). At temperatures more than 400°C (III temperature step/stage) are used the compensating lens.

For the connections of conduits/manifolds made of acid-resisting steel (group KhN) on P_y=200÷320 kg/cm² at temperature to 300°C use lens the performances ZhI made of the appropriate acid-resisting steel.

The spherical surface of lens performances KI and KII cover/coat with the layer of zinc (galvanically) with a thickness of 0.01-0.02 mm.

Constructions/designs and sizes/dimensions of the rigid and compensating lens are given in Tables 26 and 27.

Table 26. Construction/desiyn of packing lens.



Key: (1). rigid, performance. (2). Place of marking. (3). compensating for, performance KI and KII). (4). Ring (insertable. (5). it is not more.

Continuation Table 26.

(a) Тип и исполнение	(d) Размеры в мм								(e) Масса в кг
	D_y	D	D_1	D_2	$D_к$	b	b_1	R	
ЖI	6	6	—	14	8,2	8,5	—	12	0,006
ЖI	10	10	—	20	13,7	10	—	20	0,017
	15	15		30	20,5	11		30	0,03
	25	25		44	30,8	14		45	0,08
	32	32		60	41	18		60	0,16
	40	40		66	49,9			73	0,2
ЖII	40	40	65	85	49,9	30	12	73	0,68
KI			60	82		25	10		0,45
KII			66	86		30	12		0,63
ЖI	60	60	—	82	67	20	—	98	0,3
ЖII			85	116		32	14		1,3
KI				110		28	10		0,78
KII				116		32	14		1,22
ЖI	70	70	—	100	78,7	25	—	115	0,6
ЖII			100	132		38	16		1,86
KI			95	125		30	12		1,06
KII			100	132		38	16		1,7
ЖI	90	90	—	125	95,7	30	—	140	1,05
ЖII			125	155		42	17		2,51
KI			120	146		32	12		1,58
KII			125	155		42	17		2,23

Continuation Table 26.

ЖI	100	100	—	130	109,4	30	—	160	1,30
ЖII			135	168		45	19		3,38
KI	—		130	155		35	13		1,87
KII			135	168		45	19		3,12
ЖI	125	125	—	175	136,8	35	—	200	2,3
ЖII			165	200		45	19		4,57
KI	—		160	192		38	13		2,68
KII			165	200		45	19		4,22
ЖI	150	150	—	210	166,2	40	—	243	3,3
ЖII			195	245		60	26		8,43
KI	—			235		48	17		5,26
KII				245		60	26		7,93
ЖI	200	195	—	270	212	45	—	310	6,1
ЖII			245	295		60	25		11,4
KI				285		48	17		7,28
KII				296		60	26		10,8

Notes: 1. The material of lens - see Table 3.

2. D_{κ} - theoretical diameter of contact of lens with sublens conical packing surface.

3. Sizes/dimensions of insertion rings to lens of performance KI and KII are given in Table 27.

Key: (1). Type and performance. (2). Sizes/dimensions in mm. (3). Mass in kg.

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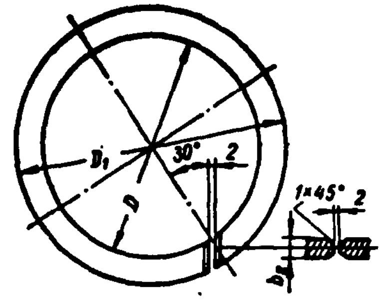
Table 27. Insertion rings to the lens of performance KI and KII.

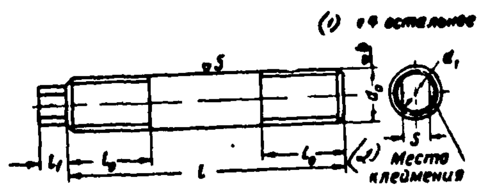


(1) Размеры в мм				(2) Масса в кг
D_y	D	D_1	b_1	
40	40	51	4,9	0,03
60	60	73	4,9	0,05
70	70	84	5,9	0,08
90	90	106	6,9	0,15
100	100	118	6,9	0,17
125	120	145	6,9	0,23
150	150	179	7,9	0,39
200	195	228	7,9	0,58

Note. Material - steel Kh3MV (18Kh3MV); HB=197-235.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

Table 28. Two-sided pins for flange joints with lens packing on P_y from 200 to 1000 kg/cm^2 (GOST 10494-63).



(3) Размеры в мм					
d_0	d_1	l_0	l_1	S	l
M14	10	30	8	8	70—120
M16	12			10	80—140

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Continuation Table 28.

M20	15	35		12	110—170
M22	17	40		14	130—[illegible]
M27	20	45	8	17	160—220
M30	22	50		19	190—[illegible]
M33	25	55		22	210—270
M36	27	60	10	24	240—320
M39	32	65	12	27	280—340
M45	38	70	14	32	310—380
M52	42	85	18	36	370—[illegible]
M56	45	95		—	[illegible]—[illegible]

Notes: 1. Material - see Table 3.

2. Thread metric with rapidly according to GOST 9150-59*. Tolerances according to the 2nd class of precision (GOST 9253-59). The form of bottom of thread must be rounded. With the execution of thread knurl the diameter of the smooth part of the pin must be, in the limits of average/mean thread diameter. With execution the threads by thread the diameter of the smooth part of the pin make

according to sizes/dimensions and with the deviations of external thread diameter. Thread must be pure/clean without barbs and stripped threads.

3. Curvature of rod of pin on 100 mm of length must not exceed: with d_0 from 12 to 24 mm - 0.2 mm; with d_0 more than 24 mm - 0.1 mm.

Key: (1). remaining. (2). Place of marking. (3). Sizes/dimensions in mm.

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Table 29. Length and weight of the pins of two-sided ones for flange joints with lens packing/seal on P_y from 200 to 1000 kg/cm² (GOST 10494-63).

(1) Размеры в мм d_0	(1) Размеры в мм l	(2) Масса 1000 шт. в кг
M14	70	76
	75	82
	80	88
	85	94
	90	100
	95	106
	100	112
	105	118
	110	124
	115	130
	120	136
M16	80	119
	85	127
	90	135
	95	143
	100	151
	105	159
	110	167
	115	176
	120	183
	125	190
	130	198
	135	206
	140	214
M20	110	243
	115	256
	120	268
	125	280
	130	299
	135	305
	140	317
	145	330
	150	342
	155	355
	160	367
	165	380
	170	392
M22	130	353
	135	368
	140	383
	145	398
	150	413
	155	428
	160	443
	165	458
	170	473
	175	488
	180	503
	185	518
	190	533
M27	160	645
	165	667
	170	690
	175	712
	180	735
	185	758
	190	780
	195	802
	200	825
	205	847
	210	870
	215	892
	220	914
M30	190	994
	195	1022
	200	1050
	205	1078
	210	1105
	215	1133
	220	1161
	225	1189
	230	1216
	235	1244
	240	1272
	245	1300
	250	1328
	255	1356
	260	1384
M33	210	1338
	215	1372
	220	1406
	225	1440
	230	1473
	235	1507
	240	1540
	245	1574
	250	1608
	255	1642
	260	1675
	265	1709
	270	1743
M36	240	1785
	245	1825
	250	1865
	255	1905
	260	1945
	265	1985
	270	2025
	280	2104
	290	2184
	300	2264
	310	2344
	320	2424
M39	280	2481
	290	2574
	300	2668
	310	2762
	320	2856
	330	2950
	340	3044
M45	310	3705
	320	3830
	330	3955
	340	4060
	350	4205
	360	4330
	370	4455
	380	4480
	390	4505
M52	370	5946
	380	6113
	390	6280
	400	6446
	410	6613
	420	6780
	430	6946
	440	7113
	450	7280
	460	7447
M56	450	8304
	460	8497
	470	8691
	480	8884
	490	9076

Key: (1). Sizes/dimensions in mm. (2). Mass 1000 pieces in kg.

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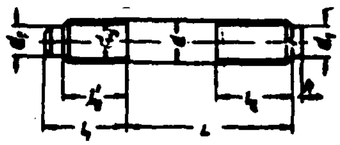
Table 30. Pins firm (screw) for fittings and shaped parts of conduits/manifolds on P_y 200-1000 kg/cm² (GOST 11447-65).



(1) Размеры в мм					
d_0	d_1	l_0	l_0'	l_1	L
M12	8	22	19	26	30—80
M14	10	25	23	31	35—90
M16	12	31	25	36	40—100
M18	13	34	30	39	40—105
M20	15	36	32	45	45—110
M22	17	39	34	47	50—120
M24	17	42	40	53	60—130
M27	20	48	43	58	70—140
M30	22	55	48	64	80—160
M33	25	55	52	68	90—180
M36	27	61	54	74	100—200
M39	30	65	[illegible]	82	[illegible]
M42	32	70	64	86	[illegible]
M45	35	72	[illegible]	92	[illegible]
M48	36	76	74	100	[illegible]
M52	40	[illegible]	78	105	[illegible]

Notes: 1. Material - see Table 3.

h=3-6 mm; $d=d_0$.

Key: (1). Sizes/dimensions in mm.

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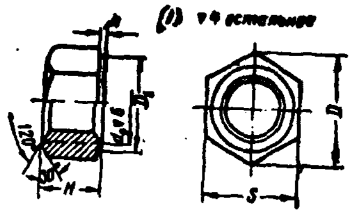
Table 31. Nuts pure/clean hexahedral for flange joints on $P_y = 200 + 1000$ kg/cm² (GOST 10495-63).



	(2) Размеры в мм				(4) Масса 1 шт. в кг
d_0	(3) S под ключ	H	D	h	
M12	19	12	21,9	2	0,019
M14	22	14	25,4		0,031
M16	24	16	27,7		0,039
M20	30	20	34,6	3	0,077
M22	32	22	36,9		0,093
M24	36	24	41,6		0,138
M27	41	27	47,3	3	0,194
M30	46	30	53,1		0,277
M33	50	33	57,7	4	0,389
M36	55	36	63,5		0,446
M39	60	39	69,3		0,637
M42	65	42	75	5	0,777
M45	70	45	80,8		1,1
M48	75	48	86,5		1,197
M52	80	52	92,4		1,42
M56	85	56	98		1,068

Notes: 1. Material - see Table 3.

Thread metric with rapidly - according to GOST 9150-59*; tolerances according to the 2nd class of precision - according to GOST 9253-59.

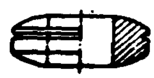
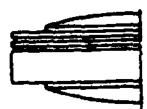
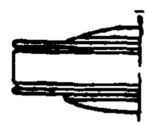
3. D_1=0.95 S.

Key: (1). remaining. (2). Sizes/dimensions in mm. (3). S under key/wrench. (4). Mass of 1 piece in kg.

Packing lens, pins and nuts depending on the trademark of steel stamped with and corresponding marking (ornamentation).

The marking of lens, which consists of brand of supplier-enteprise, the numbers of batch and trademark of steel (for lens D_y=25-200 mm), will apply on the cylindrical surface of each lens. The ornamentation of lens is given in Table 32.

Table 32. Ornamentation of lens (GOST 10493-63).

(1) Типы и исполнения линз	(2) Марка стали		
	20	20ХГ	Х3МВ (18Х3МВ)
ЖI		–	
ЖII	–		
КI	–	–	
КII	–	–	

Key: (1). Types and performances of lens. (2). Trademark of steel.

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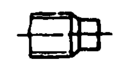
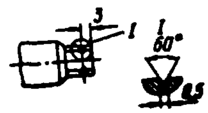
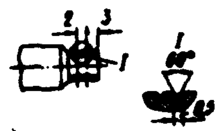
Marking (ornamentation) and marking of pins and nuts depending on brand of material are given in Tables 33 and 34. During the replacement of the trademark of steel to equivalent the ornamentation is retained.

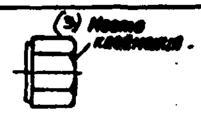
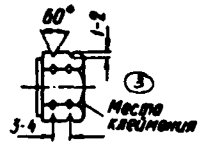
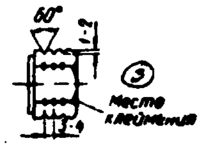
On pins and nuts in the places of marking must be plotted/applied brand or supplier-enteprise and number of batch.

Table 33. Ornamentation and marking of pins (GOST 10494-63).

(1) Марка стали	(2) Орнаментовка	(3) Клеймение
35ХГ2		 (4) место клеймения
40ХФА		
25Х2М1ФА		(5) Допускается клеймение на торце хвостовика

Key: (1). Trademark of steel. (2). Ornamentation. (3). Marking. (4). Place of marking. (5). Is allowed/assumed marking on end/face of stem.

Table 34. Ornamentation and marking of nuts (GOST 10495-63).

(1) Марка стали	(2) Орнаментовка и место клеймения
30X	
35X	
30XMA	

Key: (1). Trademark of steel. (2). Ornamentation and place of marking. (3). place of marking.

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§4. Conduits to operating pressure 1500 kg/cm².

1. Materials of ducts and parts of conduits/manifolds.

For conduits/manifolds to operating pressure 1500 kg/cm² at temperature media of 300°C use the seamless pipes from steel of 20Kh3MVF; shaped parts are prepared from forgings, stampings, round rolled stock or ducts.

Shaped parts supply in collection with threading flanges.

The parts, manufactured from the required brands/marks of steel, they must have in the heat-treated state mechanical properties and category of strength according to GOST 8479-57 (Table 35).

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2. Ducts and part of conduits/manifolds.

For ducts and parts of conduits/manifolds to operating pressure 1500 kg/cm² are used the flange joints with lens packing/seal.

The data about leads with flange joints are given in Table 36.

The list of the shaped parts of conduits/manifolds on kg/cm² is given in Table 37.

Table 35. The mechanical properties of the metal of ducts and parts of conduits/manifolds to operating pressure 1500 kg/cm² at temperature of medium to 300°C.

(1) Наименование деталей	(2) Марка стали	(3) Категория прочности	(4) Механические свойства				
			$\sigma_в$, (5) кгс/мм²	$\sigma_т$, (5) кгс/мм²	δ, %	(6) $a_н$, кгс·м/см²	HB
			(6a) не менее				
(7) Трубы, D_y=6 : 60 мм	20Х3МВФ	—	90	75	12	6	[illegible]—311
(8) Фланцы резьбовые: (9) при T (10) до 200° C	40Х	КП63А	85	68	13	6,5	248—[illegible]
» T (11) от 200 до 300° C	25Х1МФ						
(12) Заглушки	40Х	КП63А	85	63	13	6,5	248—[illegible]
(13) Линзы глухие и уплотнительные: (9) при T (10) до 200° C	40Х	КП50А	70	50	16	6	212—248
» T от 200 до 300° C (11)	20Х3МВФ		70	50	16	6	212—248
(14) Фасонные детали	20Х3МВФ	КП71А	90	71	13	6,5	269—311
(15) Шпильки	25Х1МФ	—	85	70	13	5	[illegible]
(16) Гайки	30ХМА	—	80	65	15	6	277—[illegible]

Notes: 1. The chemical compositions of the trademarks of steels are given in Chapter 1, Tables 9 and 10.

2. Ducts supply on TSFM 3-316-70.

Key: (1). Designation of parts. (2). Trademark of steel. (3). Category of strength. (4). Mechanical properties. (5). kg/mm². (6). kgf•m/cm². (6a). it is not less. (7). Ducts. (8). Flanges (threading.

(9). with. (10). to. (11). from. (12). Silencers/plugs. (13). Lens (deaf and packing). (14). Shaped parts. (15). Pins. (16). Nuts.

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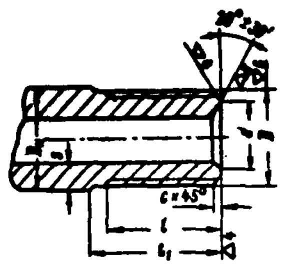
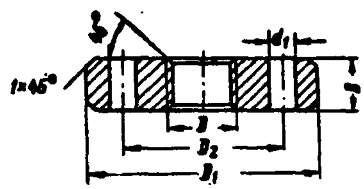
Table 36. Ends the connecting threading for the elements/cells of conduits/manifolds with lens packing/seal on $P_{раб}$ 1500 kg/cm² at temperature of medium to 300°C.





Трубы				Присоединительные концы					Фланцы					Шпильки	
размеры в мм			масса 1 пог. м в кг	размеры в мм									масса в кг	количество	резьба
D_y	$D_н$	S		D	d	l	l_1	c	D_1	D_2	B	d_1			
6	15	4,5	1,17	M14×1,5	10	22	32	1	70	42	15	16	0,37	3	M14
10	25	7	3,11	M24×2	18	28	32	1,5	95	60	20	18	0,93	3	M16
15	35	9	3,77	M33×2	28	35	42	1,5	105	68	25	18	1,34	4	M16
25	50	12	11,25	M48×2	40	40	45	1,5	145	105	30	22	2,9	6	M20
32	68	18	22,2	M64×3	55	50	60	2	165	115	35	24	4,2	6	M22
40	89	24	38,47	M85×3	68	60	70	2	200	145	45	28	7,78	6	M27
60	108	26	52,58	M105×3	90	70	80	2	240	195	55	33	16,37	8	M30

Note. Thread - according to GOST 9150-59; tolerances according to the class of precision 2a - according to GOST 9253-59; vanishing of thread - according to GOST 10549-63, angle of run of α=30°.

Key: (1). Ducts. (2). sizes/dimensions in mm. (3). mass 1 lin. m., in kg. (4). Leads. (5). Flanges. (6). mass in kg. (7). Pins. (8). Quantity. (9). Thread.

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Table 37. Enumeration of the shaped parts of conduits/manifolds on $P_{раб}=1500$ kg/cm² and $D_у=6\div60$ mm on the branch standards of Irkutskniikhimmash.

(a) № п.п.	(b) Наименование деталей	(c) Номер таблицы
1	Фланцы резьбовые	36
2	Линзы уплотнительные	37
3	Линзы глухие	38
4	Отводы линзовые	39
5	Заглушки	40
6	Тройники	41
7	Тройники-вставки	—
8	Переходы	42
9	Колена равноплечие и неравноплечие	43
10	Колена двойные	—
11	Колена с опорами	—
12	Опоры для колен	—
13	Угольники с отводами	—

Note. The parts, noted in graph/count the "number of the table" of sign "-", in handbook are not given.

Key: (a). In order. (b). Designation of parts. (c). Number of table. (1). Flanges (threading. (2). Lens (packing. (3). Lens (deaf. (4). Offtakes (lens. (5). Silencers/plugs. (6). T-connections. (7). T-connection-insert. (8). Transitions. (9). Elbows (isoceles and unequal-arm). (10). Elbows (dual. (11). Elbows with supports. (12). Supports for elbows. (13). Angle plates with offtakes.

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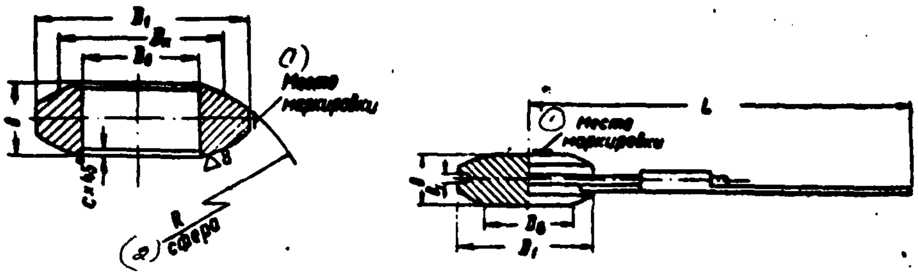
Table 38. of lens spherical packing and deaf on $P_{раб}$=1000 kg/cm².



(3) Размеры в мм									(4) Масса в кг линзы	
D_y	$D_в$	$D_к$	D_1	R	L	B	b	b_1	(5) уплотнительной	(6) глухой
6	6	8,2	14	12	57	8	8,5	1,6	0,007	0,014
10	11	13,7	22	20	76	10	10	1,6	0,02	0,037
15	17	20,5	30	30	90	15	11	2	0,03	0,65
25	26	30,8	48	43	109	20	16	2	0,115	0,201
32	32	39,7	64	58	132	20	20	2	0,247	0,399
40	41	49,9	80	73	160	25	25	2,5	0,465	0,76
60	65	65	100	98	185	30	30	3	0,846	1,473

Notes: 1. Packing surface of lens to zinc galvanically in thickness of the layer 0.01-0.02 mm.

2. C - width of indicator or deaf lens.

3. $D_к$ - diameter of contact of lens with duct or shaped part.

Key: (1). Place of marking. (2). sphere. (3). Sizes/dimensions in mm. (4). Mass in kg. of lens. (5). packing. (6). deaf.

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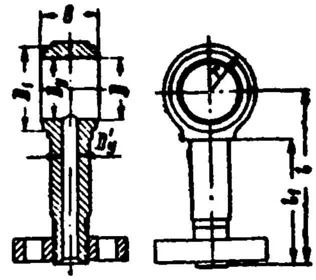
Table 39. Offtakes are lens on $p_{раб}=1500$ kg/cm².

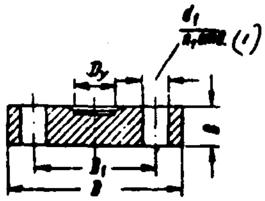


(1) Тип	(2) Размеры в мм							(3) Масса в кг
	$D_y \times D'_y$	D	D_1	L	l_1	B	r	
А	25×6	26	48	120	90	40	27,5	0,64
Б	25×10			140	110	45		0,80
А	32×6	32	60	130	96		32,5	0,96
Б	32×10			150	115	50		1,48
А	40×6	41	78		105	45	46	1,35
Б	40×10			165	120	55		2,38
А	60×6	56	100	190	130		65	2,64
Б	60×10			200	140	60		3,22

Note. Sealing spherical surfaces to zinc galvanically in thickness of the layer 0.01-0.02 mm.

Key: (1). Type. (2). Sizes/dimensions in mm. (3). Mass in kg.

Table 40. Silencers/plugs for conduits/manifolds on $P_{раб}=1500$ kg/cm².



(2) Размеры в мм					(3) Количество отверстий	(4) Масса в кг
D_y	D	D_1	B	d_1		
6	70	42	15	16	3	0,38
10	95	60	20	18		0,99
15	105	68	25		4	1,49
25	145	105	30	22	6	3,33
32	165	115	35	24		5,2
40	200	145	45	29		9,65
60	280	195	55	33	8	19,83

Key: (1). Branch. (2). Sizes/dimensions in mm. (3). quantity of holes. (4). Mass in kg.

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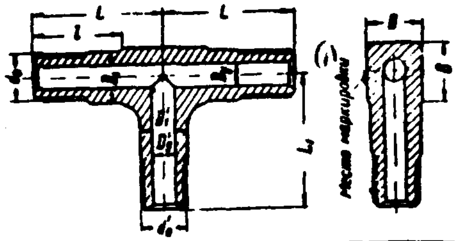
Table 41. T-connections with flanges on $P_{раб}=1500$ kg/cm².



$D_y \times D_y'$	(2) Размеры в мм d_0	D_1	d_0'	D_1'	L	L_1	l	B	(3) Масса фланцев в кг
6×6	M14×1,5	18	M14×1,5	18	70	70	45	22	0,33
10×6	M24×2	28			85	85	60	32	0,89
10×10			M24×2	28					1,07
15×6	M33×2	36	M14×1,5	18	95		65	40	1,52
15×10			M24×2	28		95			1,61
15×15			M33×2	36					1,82
25×6	M48×2	55	M14×1,5	18	125	95	75	60	4,32
25×10			M24×2	28					4,48
25×15			M33×2	36		110			4,64
25×25			M48×2	55		125	65		5,35
32×10	M64×3	70	M24×2	28	150	110	90	80	9,19
32×15			M33×2	36		120			9,7
32×25			M48×2	55		130			9,83
32×32			M64×3	70		150	80		11,28
40×25	M85×3	90	M48×2	55	170	160	100	100	17,99
40×32			M64×3	70					18,86
40×40			M85×3	90		170	90		20,78
60×32	M105×3	115	M64×3	70	225	180	110	125	37,42
60×40			M85×3	90		200			41,35
60×60			M105×3	115		225			43,88

Key: (1). Place of marking. (2). Sizes/dimensions in mm. (3). Mass of flanges in kg.

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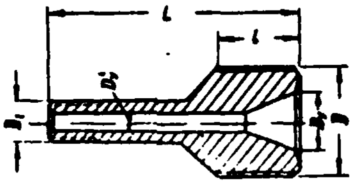
Table 42. Transitions on $P_{раб}$=1500 кг/cm².



(1) Размеры в мм					(2) Масса в кг
$D_y \times D'_y$	D	D_1	L	l	
10×6	M24×2	M14×1,5	100	28	0,2
15×6	M33×2			40	0,4
15×10		M24×2	110		0,48
25×15	M48×2	M33×2	130	45	1
32×15	M64×3		150	55	1,6
32×25		M48×2			2,29
40×25	M85×3		170	65	3,94
40×32		M64×3	190		5,03
50×32	M105×3			75	7,32
50×40		M85×3	220		10,06

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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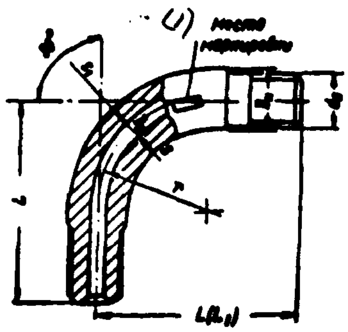
Table 43. Elbows isoceles and unequal-arm on $P_{раб}$=1500 kg/cm².



(2) Размеры в мм								(4) Масса колена в кг	
D_y	$D_н$	d_0	L	L_1	r	S (3) не менее	S_1 (3) не менее	(5) равноплечего	(6) неравноплечего
6	22	M14×1,5	70	110	32	8	6	0,30	0,34
10	32	M24×2	85	140	50	11	9	0,62	[illegible]
15	40	M33×2	95	180	60	12	10	1,1	1,37
25	60	M48×2	125	190	80	17	15	3,14	4,26
32	80	M64×3	150	245	90	24	18	6,05	[illegible]
40	100	M85×3	170	285	110	29	23	13,[illegible]	[illegible]
60	120	M105×3	225	340	140	32	26	28,34	[illegible]

Key: (1). Place of marking. (2). Sizes/dimensions in mm. (3). it is not less. (4). Mass of elbow in kg. (5). isoceles. (6). Unequal-arm.

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§5. Conduits to operating pressure 2500 kg/cm².

1. Materials for ducts and parts of conduits/manifolds.

For conduits/manifolds on $P_{раб}=2500$ kg/cm² at temperature from -40 to +300°C use jointless steel tubes of steel brands 20Kh3MVF-Sh according to TSFM 3-316-70. The shaped parts of conduits/manifolds are prepared from the forgings which in the heat-treated state on general technical requirements and categories of strength must correspond to GOST 8479-70, group IV.

Is allowed/assumed manufacture of parts from stampings, rolled stock and ducts whose strength characteristics satisfy the requirements, presented to forgings.

The trademarks of steels and the mechanical properties of ducts and parts of conduits/manifolds are given in Table 44.

The assortment of ducts and the sizes/dimensions of leads are given in Tables 45 and 46.

2. Ducts to pressure 2500 kg/cm².

Ducts supply by the length of 6-7.5 m. Is allowed/assumed the delivery of ducts in long not shorter than 3 m in the quantity not more than 20o/o.

The curvature of ducts must not exceed 2 mm on 1 m of length.

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Table 44. The mechanical properties of the metal of ducts and parts of conduits/manifolds to operating pressure 2500 kg/cm² (ON 26-01-124-69 Irkutsknlikhimmash).

Наименование детали	Марка стали	Категория прочности по ГОСТ 8479—70	Механические свойства при 20° С, не менее					HB
			$\sigma_в$	$\sigma_т$	δ_5	ψ	$a_н$, кгс·м/см²	
			кгс/мм²		%			
Трубы	20Х3МВФ-Ш	—	90	75	12	40	6	269—311
Детали муфтового соединения	25Х1МФ 25Х2М1Ф	КП63А	86	63	13	50	6	248—293
Тройники Угольники Переходы	20Х3МВФ 25Х1МФ 25Х2М1Ф	КП71А	90	70	13	40	6	269—311
Фланцы резьбовые и глухие	35ХМ 40Х 40ХФА	КП63А	86	63	13	50	6	248—293
Фланцы приварные	20	КП20	40	20	25	55	5,5	111—156
Линзы	35ХМ 40ХФА	—	135	120	9	40	5	47—49 HRC
Шпильки	25Х1МФ	—	86	70	13	50	6	255—302
Гайки	30ХМА	—	80	65	15	50	6	277—299

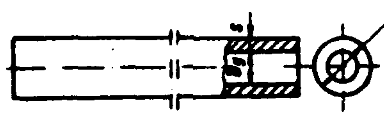
Notes: 1. Material - steel of brands 20Kh3MVF, 25Kh1MF, 25Kh2M1F according to GOST 10500-63; 35KhM, 40Kh, 30KhMA, 40KhFA according to GOST 4543-71; steel 20 according to GOST 1050-60*.

2. Chemical compositions of trademarks of steels are given in chapter 1, §2, Tables 4, 9 and 10.

3. Is permitted the use/application of other trademarks of steels whose property than not lower indicated in table.

Key: (1). Designation of part. (2). Trademark of steel. (3). Category of strength according to GOST 8479-70. (4). Mechanical properties with 20°C, are not less. (5). kg/mm². (6). kgf•m/cm². (7). Ducts. (8). Parts of sleeve joint. (9). T-connections. (10). Angle plates. (11). Transitions. (12). Flanges (threading and deaf). (13). Flanges (welded. (14). Lens. (15). Pins. (16). Nuts.

Table 45. Ducts steel jointless to pressure 2500 kg/cm² (ON 26-01-100-69 and TSFM 3-316-70).



	(2) Размеры в мм				(6) Масса 1 пог. м в кг
	$D_н$		S		
D_y	(3) номинальный	(4) допускаемое отклонение	(3) номинальный	(4) допускаемое отклонение	
3	12	±0,3	4,5	±8%	0,83
6	17	±0,3	5,5	±8%	1,55
10	28	±0,3	9	±8%	4,2
16	40	±0,4	12,5	±10%	8,4
25	63	±1%	19	±10%	20,8
32	83	±1%	24	±10%	32
40	98	±1%	29	±10%	40

Key: (1). Assortment. (2). Sizes/dimensions in mm. (3). nominal. (4). manufacturing tolerance. (5). Mass 1 lin. m, in kg.

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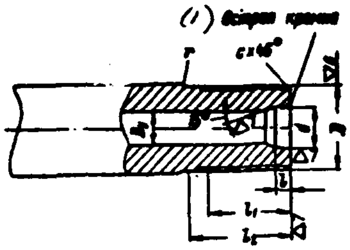
Table 46. Ends the connecting threading for clutch and flange joints to pressure 2500 kg/cm² (ON 26-01-101-69).



(2) Размеры в мм							
D_y	D	d	l	l_1	l_2	r	c
3	M10×1	3,5	5	34	37	5	1
6	M16×1,5	7		47	51		1,6
10	M27×2	11		60	65	10	2
15	M39×3	16	10	73	79		2,5
25	M60×4	28		60	68	16	3
32	M80×4	35		70	78		
40	M95×4	42		80	88		

Key: (1). Sharp edge. (2). Sizes/dimensions in mm.

3. The parts of the conduits/manifolds (to operating pressure 2500 kg/cm²).

Of the parts of conduits/manifolds to operating pressure 2500

kg/cm² prepare on branch standards ON 26-01-100-69 - ON 26-01-124-69, developed by Irkutsk NIIKhimmash, according to the list given in Table 47.

The thread of the male threads (on GOST 9150-59*) in articles and the treatment of packing surfaces are accomplished/realized on the machine tools from one installation. Thread must be pure/clean with smooth surface without burrs and pits. The presence of threads with the stripped or imperfect thread, and also defects/flaws, which prevent screwing on or screwing up of go gauge, is not allowed/assumed; the form of the hollows of the male threads - rounded. Vanishing of thread - according to GOST 10549-63*, angle of run of 30°. Undercut of the female thread - reduced according to GOST 10549-63*.

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Faces of flanges and threading ends of the parts must be strictly perpendicular to the axis/axle of thread. Manufacturing tolerances - with respect to IX degree of accuracy, GOST 10356-63.

Elbows and set-off bends prepare pliable from ducts. The minimum wall thickness is checked on the cut parts during the adjustment of technology they are pliable. The ovality of section/cut in the places

of the bend of elbows, defined as the ratio of the difference between the greatest and throat diameters in the place of bend to diameter out of bend, must not exceed 0.1.

The manufacturing tolerance of angle of the bent elbows must not exceed +-2°.

During the manufacture of the bent parts it is necessary for stress relieving after flexure to subject to their heat treatment - high-temperature temper.

The axes/axles of the straight portions of dual elbows must be parallel and lie/rest at one plane. Parallel misaligment and flatness - are not more than 0.5 mm by 100 mm of length.

Table 47. Enumeration of standards on the part of conduits/manifolds to pressure 2500 kg/cm².

(1) Наименование	(2) Номер нормали	(3) Номер таблицы
(4) Трубы стальные бесшовные	ОН 26-01-100-69	45
(5) Концы присоединительные резьбовые	ОН 26-01-101-69	46
(6) Соединения муфтовые	ОН 26-01-102-69	48
(7) Линзы конические	ОН 26-01-103-69	60
(8) То же, глухие	ОН 26-01-104-69	60
(9) Соединения фланцевые	ОН 26-01-105-69	49, 50
(10) Переходы	ОН 26-01-106-69	51
(11) Тройники проходные	ОН 26-01-107-69	52
(12) » переходные	ОН 26-01-108-69	53
(13) Угольники	ОН 26-01-109-69	—
(14) Колена гнутые из труб	ОН 26-01-110-69	54
(15) » двойные » »	ОН 26-01-111-69	55
(16) Трубы гнутые	ОН 26-01-112-69	—
(17) » с паровыми рубашками	ОН 26-01-113-69	56
(18) Колена с паровыми рубашками	ОН 26-01-114-69	57
(19) Втулки резьбовые	ОН 26-01-115-69	—
(20) Штуцера приварные	ОН 26-01-116-69	—
(21) Соединения фланцевые труб с рубашками	ОН 26-01-117-69	58, 59, 61
(22) Шпильки двусторонние	ОН 26-01-118-69	62
(23) » ввертные	ОН 26-01-119-69	63
(24) Гайки шестигранные	ОН 26-01-120-69	64
(25) Линза специальная	ОН 26-01-121-69	—
(26) Кольцо центрирующее специальное	ОН 26-01-122-69	—
(27) Фланец резьбовой специальный	ОН 26-01-123-69	—
(28) Технические требования	ОН 26-01-124-69	—

Note. The parts, noted in graph/count the "number of table" by sign "-", in handbook are not given.

Key: (1). Designation. (2). Number of standard. (3). Number of table. (4). Ducts steel jointless. (5). Ends connecting threading. (6). Connections (coupling). (7). Lens (conical. (8). Then, deaf. (9). Connections (flanged. (10). Transitions. (11). T-connections (passage). (12). T-connections (transitional. (13). Angle plates. (14). Elbows, bent from ducts. (15). Elbows (dual from ducts). (16). Ducts, bent. (17). Ducts with steam jackets. (18). Elbows with steam jackets. (19). Bushings (threading). (20). Connecting pipe (welded). (21). Connections flanged tubes with jackets. (22). Pins (two-sided).

(23). Pins (screw). (24). Nuts (hexahedral). (25). Lens special. (26). Ring centering special. (27). Flange threading special. (28). Technical requirements.

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Faces of dual elbows must lie/rest at one plane. Allowable displacement - in the limits of the 7th degree of accuracy to the length of the straight/direct section of the set-off bend according to GOST 10356-63.

The correctness of the form of the packing surfaces of lens sizes/dimensions is independent or provided by the manufacture of lens on the machine tools the sum of tolerances of which to radial axial play (GOST 42-56) does not exceed 0.02 mm.

Union couplings and parts of conduits/manifolds, which work under pressure 2500 kg/cm², according to structural/design sign divide into clutch ones for internal diameters 3, 6, 10 and 15 mm and flanged for internal diameters 25, 32 and 40 mm.

The connections indicated are reprerented two types:

type A - for union coupling and parts of the conduits/manifolds

between themselves;

type B - for the addition of ducts to apparatuses.

The basic dimensions of clutch and flange joints are given in Tables 48 and 49.

AD-A084 528 FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH F/G 5/2
HANDBOOK ON SPECIAL WORKS. TECHNOLOGICAL LINES OF INDUSTRIAL EN--ETC(U)
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5 - 6

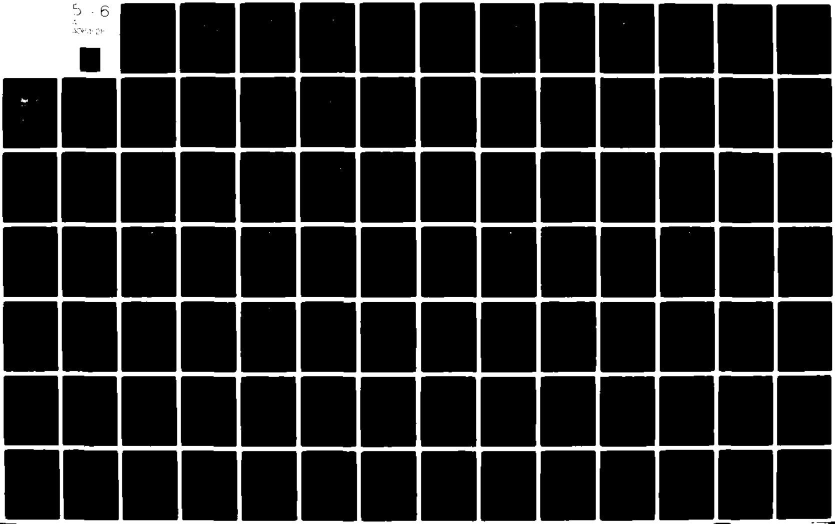
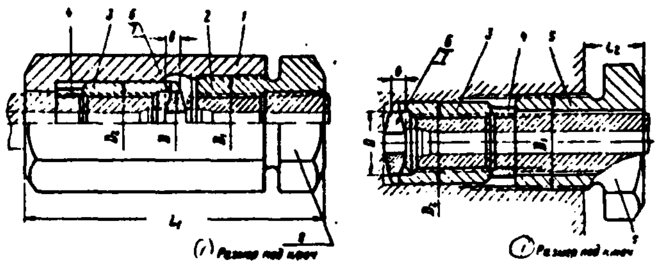


Table 48. Connections clutch of conduits/manifolds to pressure of 2500 kg/cm² (ON 26-01-102-64).



Key: (1). Width across flats.

1 - nut is cover; 2 - bushing threading; 3 - nut firm; 4 - nut lock; 5 - screw/propeller of the pressure; 6, 7 - lens passage and deaf.

(1) Размеры в мм								(2) Масса в сборе без линзового уплотнения в кг	
D_y	D	D_1	D_2	L_1	L_2	(3) S под «ключ»	b	(4) тип А	(4) тип Б
3	12	M24×2	20	85	18,6	32	4	0,40	0,2
6	17	M30×2	25	105	20,6	41	5	1,01	0,36
10	28	M24×3	37	130	25,6	60	7	2,52	0,77
15	41	M56×3	51	170	31,6	80	9	5,40	1,66

Note. Thread metric - according to GOST 9150-59*, tolerances of thread according to the classes of precision 2a - according to GOST 10191-62.

Key: (1). Sizes/dimensions in mm. (2). Mass in collection without lens packing/seal in kg. (3). Under "key/wrench". (4). type.

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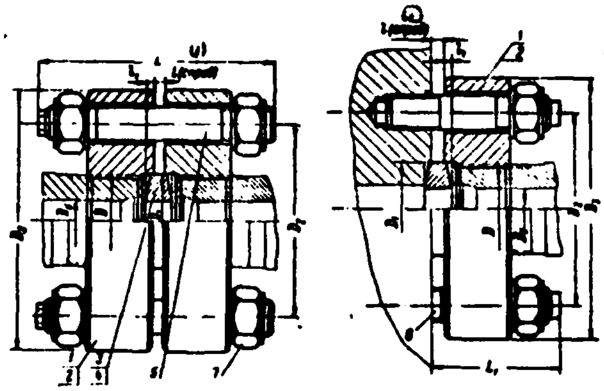
Table 49. Connections flanged to pressure 2500 kg/cm² (ON 26-01-105-69).

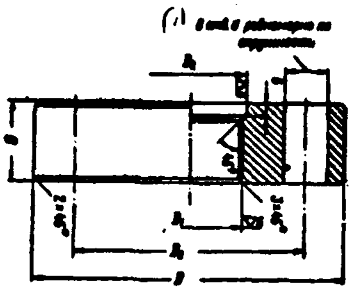


Key: (1). from the right.
1 - flange of the threading; 2 - flange of the deaf; 3 - lens passage; 4 - lens deaf; 5 - pin two-sided; 6 - pin screw; 7 - nut.

(1) Размеры в мм								
D_y	D	D_1	D_2	D_3	L	L_1	l	l_1
25	M60×4	63	136	185	178	98	8	6,5
32	M80×4	83	170	230	213	115	9	7,5
40	M95×4	98	205	275	250	140	12	8,5

Key: (1). Sizes/dimensions in mm.

Table 50. Flanges threading to pressure 2500 kg/cm² (ON 26-01-105-69).



(2) Размеры в мм								(3) Масса в кг
D_y	D	D_1	D_2	D_3	d	B	b	
25	185	M60×4	63	135	28	50	10	8,2
32	230	M80×4	83	170	33	60	11	14,9
40	275	M95×4	98	205	39	70	12	24,85

Key: (1). In branch - even in circumference. (2). Sizes/dimensions in mm. (3). Mass in kg.

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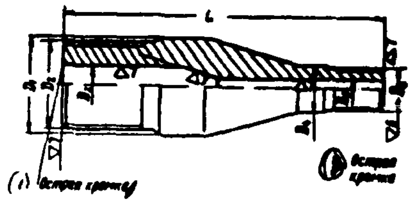
Table 51. Transitions on $P_{раб}$ = kg/cm² (ОН 26-01-106-69).



$D_y \times D'_y$	D_1	D_2	D_3	D_4	D_5	D_6	L	(2) Масса в кг
6×3	17	M16×1,5	7	12	M10×1	3,5	140	0,17
10×6	28	M27×2	11	17	M16×1,5	7,0	180	0,[illegible]
15×10	40	M39×3	16	28	M27×2	11,0	220	1,35
25×15	63	M60×4	28	40	M39×3	16,0	270	3,54
32×15	85	M80×4	35				316	6
40×25	98	M95×4	42	63	M60×4	20,0	320	11,2

Note. Tolerances of thread according to the class 2aD - according to GOST 10191 - 62.

Key: (1). Sharp edge. (2). Mass in kg.

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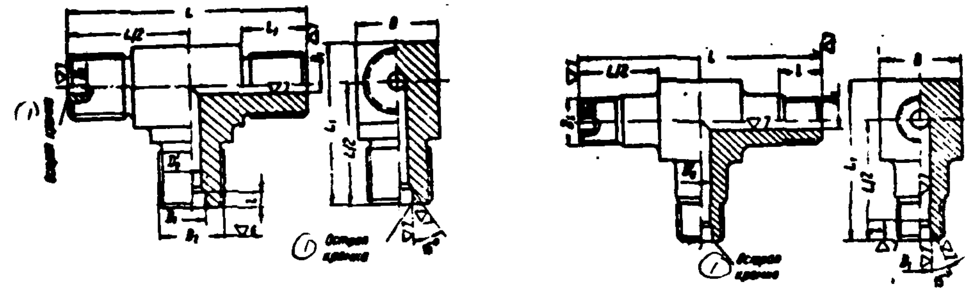
Table 52. T-connections passage on $P_{раб} = 2500$ kg/cm² (ON 26-01-107-69) [1].

FOOTNOTE [1]. See notes to Table 51. ENDFOOTNOTE.



(2) Тип	(3) Размеры в мм								(4) Масса в кг
	$D_y \times D'_y$	D_1	D_2	L	L_1	l	l_1	B	
А	3×3	3,5	M24×2	100	63	5	35	27	0,52
	6×6	7	M30×2	130	85		42	40	1,15
	10×10	11	M42×3	160	104		46	48	2,32
	15×15	16	M56×3	200	135	10	50	70	6,8
Б	25×25	28	M60×4	340	225		68	110	16,5
	32×32	35	M80×4	420	280		76	140	33,5
	40×40	42	M95×4	500	335		88	170	60

Key: (1). Sharp edge. (2). Type. (3). Sizes/dimensions in mm. (4). Mass in kg.

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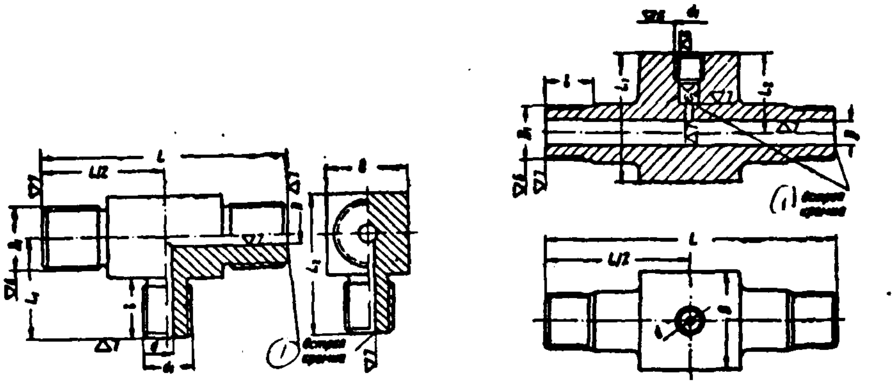
Table 53. T-connections transitional on $P_{раб}=2500$ kg/cm² (ON 26-01-108-69)[1].

FOOTNOTE [1]. See note to Table 51. ENDFOOTNOTE.



(2) Размеры в мм

(3) Тип	$D_y \times D'_y$	D	D_1	d	d_1	L	L_1	L_2	l	B	(4) Масса в кг
А	10×3	11	M42×3	3,5	M24×2	160	[illegible]	[illegible]	35	40	2,15
	10×6			7	M30×2		66	90	42		[illegible]
А	15×3	16	M56×3	3,5	M24×2	200	70	105	35	70	5,57
	15×6			7	M30×2		77	112	42		5,67
	15×10			11	M42×3		81	116	46		5,94
Б	25×3	28	M60×4	3,5	M24×2	340	140	86	68	110	16,92
	32×3	35	M80×4			420	160	90	78	140	31,55
	40×3	42	M95×4			500	180	95	88	170	54,57
	25×6	28	M60×4	7	M30×2	340	160	105	68	110	18,62
	32×6	35	M80×4			420	180	110	78	140	34,55
	40×6	42	M95×4			500	200	115	88	170	[illegible]
	25×10	28	M60×4	11	M42×3	340	190	135	68	110	21
	32×10	35	M80×4			420	210	140	78	140	38,57
	40×10	42	M95×4			500	225	140	88	170	64,14

Key: (1). Sharp edge. (2). Sizes/dimensions in mm. (3). Type. (4). Mass in kg.

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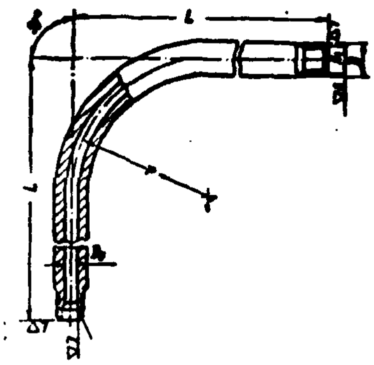
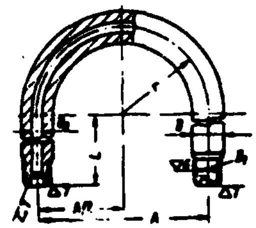
Table 54. Elbows bent from ducts on $P_{раб}=2500$ kg/cm² (ОН 26-01-110-69).



(1) Размеры в мм						(3) Масса в кг
D_y	D	D_1	r	L	(2) развернутая длина	
3	12	M10×1	90	290	542	0,46
6	17	M16×1,5	120	320	589	0,92
10	28	M27×2	170	370	667	2,21
15	40	M39×3	180	380	683	5,79
25	63	M60×4	285	535	948	19,5
32	83	M80×4	330	570	1088	35
40	98	M95×4	390	640	1113	54,9

Key: (1). Sizes/dimensions in mm. (2). expanded/scanned length. (3). Mass in kg.

Table 55. Elbows dual from ducts on $P_{раб} = 2500$ kg/cm² (ON 26-01-111-69).



(1) Размеры в мм							(3) Масса в кг
D_y	D	D_1	r	L	A	(2) Развернутая длина	
3 6 10 15	12 17 25 40	M10×1 M16×1,5 M27×2 M39×3	90 120 170 180	200	180 240 340 380	684 778 934 986	0,57 1,22 3,95 8,2
25 32 40	68 85 95	M60×4 M80×4 M95×4	285 320 380	280	570 640 760	1396 1506 1726	28,8 52,4 85,2

Key: (1). Sizes/dimensions in mm. (2). expanded/scanned length. (3). Mass in kg.

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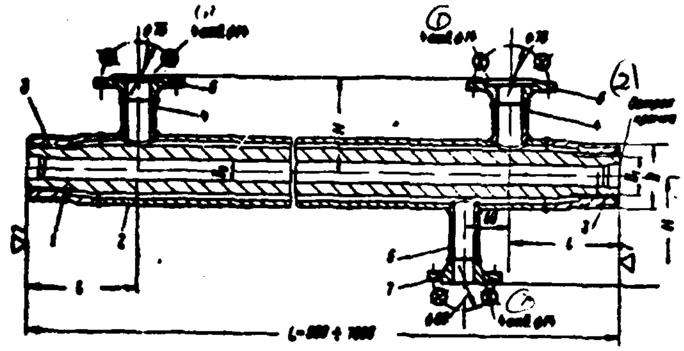
Table 56. Ducts with steam jackets on $P_{раб}$=2500 kg/cm² (ON 26-01-113-69).



Key: (1). Branch. (2). Sharp edge.

1 - duct; 2 - jacket; 3 - bushing threading; 4, 5 - connecting pipe; 6, 7 - flanges.

(1) Размеры в мм					(2) Масса в кг
D_y	D	D_1	l	H	
10	M48×3	21	125	[illegible]	12,9
15	M60×4	33	130	160	18,7
25	M80×4	54	165	175	35,2
32	M100×4	74	180	190	54,6
40	M120×4	89	215	235	74,4

Notes: 1. Mass is given for 1 lin. m of duct with jacket, bushings, connecting pipes and flanges.

2. Jackets and connecting pipe - duct according to GOST 8732-70; material - steel 20 according to GOST 1050-60*, 10G2 according to

GOST 4543-71*.

3. Bushings threading - steel 20 according to GOST 1050-60, 10G2 according to GOST 4543-71*.

4. Flanges - according to GOST 12831-67*.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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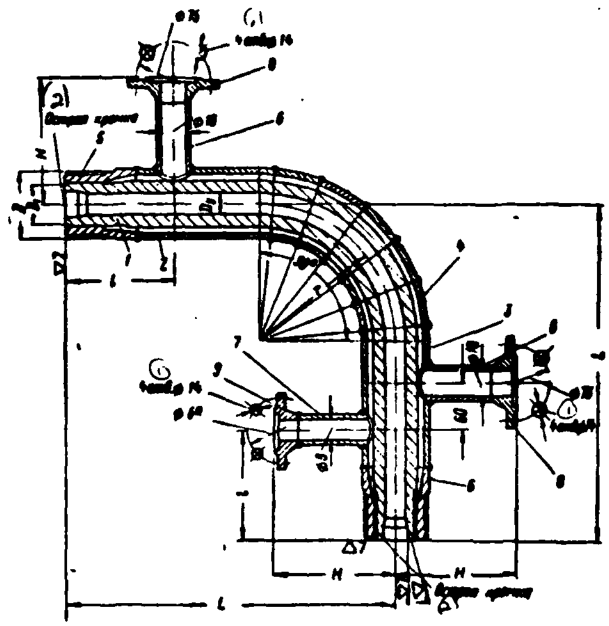
Table 57. Elbows with steam jackets on $P_{раб}=2500$ kg/cm² (ON 26-01-114-69)[1].

FOOTNOTE [1]. Material - see notes to table 56. ENDFOOTNOTE.



Key: (1). Branch. (2). Sharp edge.

1 - elbow; 2, 3 - branch connections; 4 - sector; 5 - bushing threading; 6, 7 - Connecting pipe; 8, 9 - flanges.

(1) Размеры в мм							(2) Масса в кг
D_y	D	D_1	L	l	H	r	
10	M48×3	21	425	125	150	170	13,4
15	M60×4	33	440	130	160	180	15
25	M80×4	51	580	165	175	285	32,1
32	M100×4	74	630	180	195	320	43,3
40	M120×4	89	735	215	205	380	63,7

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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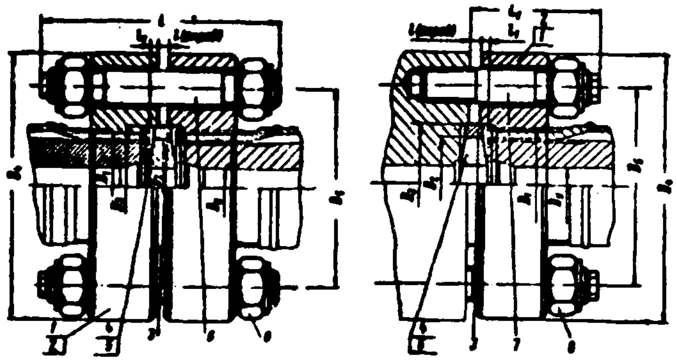
Table 58. The flange joints of ducts with steam jackets (ON 26-01-117-69).

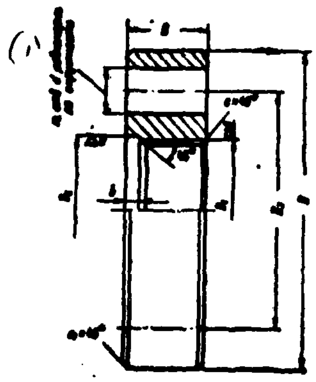


1 - flange threading; 2 - flange of the deaf; 3 - ring centering; 4 - lens passage; 5 - lens deaf; 6 - pin two-sided; 7 - pin screw; 8 - nut.

(1) Размеры в мм									
D_y	D_1	D_2	D_3	D_4	D_5	L	L_1	l	l_1
10	M40×3	28	52	125	90	110	60	3,5	3
15	M60×4	41	65	160	115	143	75	4,5	4,5
25	M80×4	68	85	185	135	178	95	8	6,5
32	M100×4	83	105	220	170	213	115	9	7,5
40	M120×4	96	125	275	205	260	140	12	8,5

Key: (1). Sizes/dimensions in mm.

Table 59. Flanges threading for union coupling with steam jackets (ON 26-01-117-69).



(2) Размеры в мм									(3) Масса в кг
D_y	D	D_1	D_2	D_3	d	n	B	b	
10	125	M48×3	52	90	18	4	30	7	2,41
15	160	M60×4	65	115	20		35	10	4,2
25	185	M80×4	85	135	26	6	50		7,32
32	230	M100×4	105	170	33		60	11	13,6
40	275	M120×4	125	205	30		70	12	22,0

Key: (1). In branch it is even in circumference. (2). Sizes/dimensions in mm. (3). Mass in kg.

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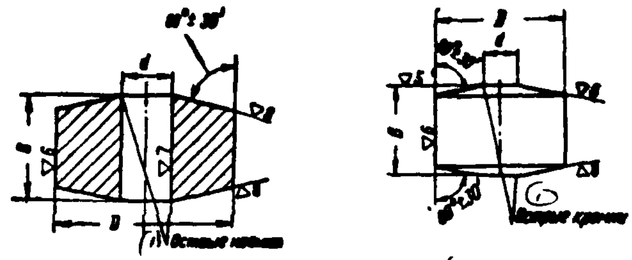
Table 60. Lens conical passage and deaf to pressure 2500 kg/cm².

(ОН 26-01-103-60) (ОН 26-01-104-60)



Размеры в мм (2)				Масса в кг (3)	
D_y	d	D	B	(4) проходные	(5) глухие
3	3	12	6,5	0,005	0,005
6	6	17	8	0,01	0,013
10	10	28	10	0,04	0,04
15	15	41	14	0,1	0,121
25	25	62	22	0,45	0,52
32	32	80	25	0,68	0,84
40	40	90	30	1,27	1,54

Key: (1). Sharp edges. (2). Sizes/dimensions in mm. (3). Mass in kg. (4). passage. (5). deaf.

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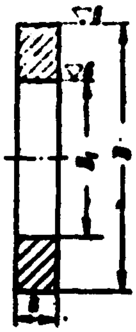
Table 61. Rings centering (ON 26-01-117-69).

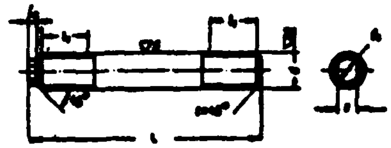


(1) Размеры в мм				(2) Масса в кг
D_y	D	D_1	B	
10	[illegible]	[illegible]	7	0,08
15	65	41	10	0,16
25	85	65	15	0,3
32	105	[illegible]	16	0,44
40	125	90	20	0,7

Note. Material - steel cf brand 35KhM according to GOST 4543-71.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

Table 62. Pins two-sided (ON 26-01-118-69).



(1) Размеры в мм							(2) Масса в кг
d	d_1	l_1	l_2	(3) S под ключ	C	L	
M16×1,5	12	30	8	10	2	118	0,17
M20×1,5	15	40		12	2,5	143	0,3
M24×2	18			14		178	0,63
M30×2	22	45		19		213	1,06
M36×3	27	55	10	24	3	250	1,8

Notes: 1. The curvature of the rod of pin on 100 mm of length must not exceed 0.2 mm with the diameter of pin to 24 mm and 0.1 mm with the diameter more than 24 mm.

2. Is allowed/assumed execution of thread on pins by method of knurl.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg. (3). under "key/wrench".

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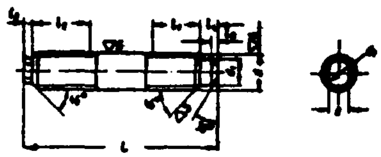
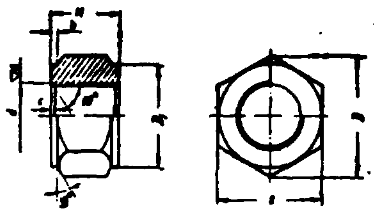
Table 63. Pins screw (ОН 26-01-119-69).



<table>
<tr><th colspan="9">(1) Размеры в мм</th><th rowspan="2">(2) Масса в кг</th></tr>
<tr><th>d</th><th>d_1</th><th>l_1</th><th>l_2</th><th>l_3</th><th>l_4</th><th>l_5</th><th>(3) S под «ключ»</th><th>L</th></tr>
<tr><td>M16×1,5</td><td>12</td><td>22</td><td>30</td><td rowspan="4">8</td><td>10</td><td>2</td><td>10</td><td>95</td><td>0,15</td></tr>
<tr><td>M20×1,5</td><td>15</td><td>30</td><td>40</td><td rowspan="2">13</td><td rowspan="2">3</td><td>12</td><td>116</td><td>0,25</td></tr>
<tr><td>M24×2</td><td>18</td><td>35</td><td>40</td><td>14</td><td>146</td><td>0,44</td></tr>
<tr><td>M30×3</td><td>22</td><td>42</td><td>45</td><td>16</td><td>5</td><td>19</td><td>170</td><td>0,82</td></tr>
<tr><td>M36×3</td><td>27</td><td>50</td><td>55</td><td>10</td><td>20</td><td>6</td><td>24</td><td>200</td><td>1,65</td></tr>
</table>

Key: (1). Sizes/dimensions in mm. (2). Mass in kg. (3). under "key/wrench".

Table 64. Nuts hexahedral (ОН 26-01-120-69).



(1) Размеры в мм							(2)
d	D	D_1	S (3) под «ключ»	H	h	C	Масса в кг
M16×1,5	27,7	23	24	16	2	2	0,04
M20×1,5	34,6	28	30	20	3	3	0,08
M24×2	41,6	34	36	24	3	3	0,13
M30×2	53,1	44	46	30		3	0,25
M36×2	63,5	53	55	36	4	4	0,45

Key: (1). Sizes/dimensions in mm. (2). Mass in kg. (3). under "key/wrench".

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Marking.

On ducts and shaped parts the marks will apply by electric spark method. Ducts and shaped parts with the internal diameter more than 15 mm are allowed/assumed to stamp by percussive method. The height

of marks in both cases must be equal to 5 mm.

During the manufacture of ducts with steam jackets the available marks on high-pressure are placed on the jacket. The locations of marks and their content make according to table 65. Marks cover/coat with clear varnish and encircle by oil paint.

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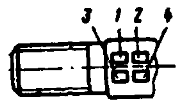
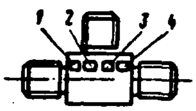
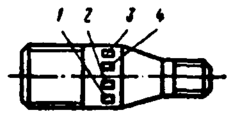
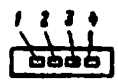
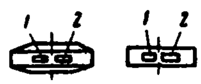
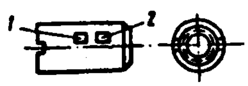
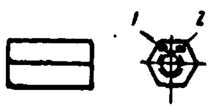
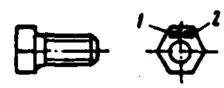
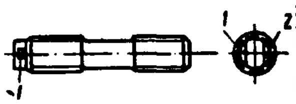
Table 65. Marking ducts and parts to pressure 2500 kg/cm² (ON 26-01-124-69).

(1) Наименование деталей	(2) Эскиз	(3) Содержание клейм
(4) Трубы, колена		(5) 1 — номер партии; 2 — номер детали; 3 — рабочее давление; 4 — марка стали
(6) Тройники		(5) 1 — номер партии; 2 — номер детали; 3 — рабочее давление; 4 — марка стали
(7) Переходы		(5) 1 — номер партии; 2 — номер детали; 3 — рабочее давление; 4 — марка стали
(8) Фланцы		(5) 1 — номер партии; 2 — номер детали; 3 — рабочее давление; 4 — марка стали
(9) Линзы, кольца		(10) 1 — номер партии; 2 — номер детали
(11) Гайка упорная, контргайка		(10) 1 — номер партии; 2 — номер детали
(12) Гайка накидная		(10) 1 — номер партии; 2 — номер детали

continuation Table 65.

(13) Гайка нажимная, муфта резьбовая		(10) 1 — номер партии; 2 — номер детали
(14) Шпильки		(15) 1 — номер партии; 2 — товарный знак
(16) Гайки		(15) 1 — номер партии; 2 — товарный знак

Key: (1). Designation of parts. (2). Drawing/draft. (3). Content of marks. (4). Ducts, elbow. (5). 1 - number of batch; 2 - parts number; 3 - operating pressure; 4 - trademark of steel. (6). T-connections.

(7). Transitions. (8). Flanges. (9). Lens, ring. (10). 1 - number of batch; 2 - parts number. (11). Nut firm, nut lock. (12). Nut cover. (13). Nut pressure/clamping, clutch threading. (14). Pins. (15). 1 - number of batch; 2 - brand. (16). Nuts.

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Chapter VII.

DUCTS AND PARTS OF CONDUITS FROM NONFERROUS METALS AND ALLOYS.

§1. General information.

Ducts and parts of conduits/manifolds from nonferrous metals and alloys use for the transporting of different agressive products, and also under conditions low-temperature.

The fundamental characteristics of the most widely used ducts from aluminum alloys, brass, copper and lead are given in Table 1.

Wrought pipes and parts of conduits/manifolds from the aluminum alloys of copper and brass are standardized. The enumerations of the standardized parts are given in Tables 3, 11 and 24.

§2. Ducts and part of conduits/manifolds from aluminum and aluminum alloys.

1. Ducts aluminum pulled and pressed.

Ducts pulled (GOST 1947-56*, 4773-65), manufactured with cold drawing and cold rolling from aluminum and aluminum alloys, in form and state of material divide into:

ducts circular annealed (M), hardened/tempered and naturally aged (T), hardened/tempered and artificially aged (T1) and cold-worked (N);

duct shaped (square, right angled and drop-like) annealed (M), hardened/tempered and logically aged (T) and hardened/tempered and artificially aged (T1).

Ducts those pressed (GOST 1947-56*, 11535-65), manufactured with the method of hot pressing, divide into thick-walled (S≥5 mm) those hardened/tempered and logically those aged (T), hardened/tempered and artificially aged (T1) and without heat treatment (without index) and thin-walled (S<5 mm) hardened/tempered and are logical those aged (T), also, without heat treatment (without index).

For technological conduits/manifolds are used circular ducts.

Ducts circular pulled supply by sizes/dimensions in mm:

the outside diameter: 6; 7; 8; 9; 10; 11; 12; 14; 16; 18; 20; 22; 24; 25; 26; 28; 30; 32; 34; 36; 38; 40; 42; 45; 48; 50; 52; 55; 58; 60; 65; 70; 75; 80; 85; 90; 95; 100; 105; 110; 115; 120;

the wall thickness: 0.5; 0.75; 1; 1.5; 2; 2.5; 3; 3.5; 4; 5.

Ducts circular pressed supply by sizes/dimensions in mm:

the outside diameter: 18; 20; 22; 24; 25; 26; 28; 30; 32; 34; 36; 38; 40; 42; 45; 48; 50; 56; 58; 60; 62; 65; 70; 75; 80; 85; 90; 95; 100; 105; 110; 115; 120; 125; 130; 135; 140; 145; 150; 155; 160; 165; 170; 175; 180; 185; 190; 195; 200; 210; 220; 230; 240; 250; 260; 270; 280;

the wall thickness: 1.5; 2; 2.5; 3; 3.5; 4; 4.5; 5; 6; 7; 7.5; 8; 9; 10; 12.5; 15; 17.5; 20; 22.5; 25; 27.5; 30; 32.5.

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Table 1. Fundamental characteristics of ducts from nonferrous metals and alloys.

(1) Наименование труб	(2) № ГОСТа или нормали машиностроения	(3) Размеры в мм		(4) Материал труб	(5) Пределы применения		(6) № таблицы по данной главе
		$D_н$	S		(7) температура продукта в °C	(8) давление в кгс/см²	
					(9) не выше		
(10) Тянутые из алюминия и алюминиевых сплавов	ГОСТ 1947—56*, ГОСТ 4773—65	6—120	0,5—5	(11) Алюминий марок АД, АД1, АД0, АД00, алюминиевые сплавы марок Д1, Д16, АВ, АМц, АМг2, АМг3, АМг5, АМг6 по ГОСТ 4784—65	От —196 до +150 (12)	По расчету (13)	2
(14) Прессованные из алюминия и алюминиевых сплавов	ГОСТ 1947—56*, ГОСТ 11535—65	18—280	1,5—32,5	(15) Алюминий марок АД0, АД1 и АД и алюминиевые сплавы марок Д1, Д16, АВД1-1, В95, АК6, АВ, АМц, АМг2, АМг3, АМг5 и АМг6 по ГОСТ 4784—65 и 1131—67	То же (16)	То же (16)	2
(17) Сварные из алюминиевых сплавов	МН 1100-60, МН 1112-60	103—1012	1,5—6	(18) Лист алюминиевого сплава по ГОСТ 13722—68	(12) От —196 до +120	(18) $P_{раб}$ до 2,5	4
(19) Медные тянутые	ГОСТ 617—64*	3—360	0,5—10	(20) Медь марок М1, М2, М3, М3р по ГОСТ 859—66 и томпак марки Л96 по ГОСТ 15527—70	От —196 до +250 (12)	По расчету (13)	9
(21) Медные прессованные	ГОСТ 617—64*	30—280	5—30	То же (16)	(16) То же	(16) То же	9
(22) Медные сварные	МН 1130-60, МН 1166-60	410—510	5	(23) Медь марки М3 по ГОСТ 617—64 и 859—66, лист по ГОСТ 495—70	От —196 до +120 (12)	$P_{раб}$ до 6 (15)	12
(24) Медные и латунные тонкостенные	ГОСТ 11383—65	1,5—28	0,15—0,7	(25) Медь марок М1, М2, М3 по ГОСТ 859—66, латунь марок Л96, Л68, Л63 по ГОСТ 15527—70	—	—	22
(26) Латунные тянутые	ГОСТ 494—69	3—100	0,5—10	(27) Латунь марок Л63, Л68, ЛО70-1, ЛА77-2, ЛМШ68-0,05, ЛАМш77-2-0,05 и ЛОМш70-1-0,05 по ГОСТ 15527—70	—	—	23
(28) Латунные прессованные	ГОСТ 494—69	21—195	1,5—42,5	(29) Латунь марок Л63, ЛС59-1 и ЛЖМц59-1-1 по ГОСТ 15527—70	—	—	23
(30) Латунные сварные	МН 1113-60, МН 1135-60	103—1012	1,5—6	(31) Латунь марки Л63 по ГОСТ 15527—70, лист по ГОСТ 931—70	От —196 до +120 (12)	$P_{раб}$ до 6 (8)	4
(32) Бронзовые прессованные	ГОСТ 1208—54	50—220	5—50	Бронза марок (33) БрАЖМц10-3-1,5 и БрАЖН10-4-4 по ГОСТ 493—54	—	—	30
(34) Свинцовые	ГОСТ 167—69	15—170	2,5—10	(35) Свинец марок С0, С1, С2, С3 по ГОСТ 3778—65	—	—	31

Key: (1). Designation of ducts. (2). No of Gost or standard of machine-building. (3). Sizes/dimensions in mm. (4). Material of ducts. (5). Limits of use/application. (6). No of table on this

chapter. (7). temperature of product in °C. (8). pressure in kg/cm². (9). it is not above. (10). Pulled from aluminum and aluminum alloys. (11). Aluminum of AD brands/marks, AD1, AD0, AD00, aluminum alloys of brands D1, D16, AV, AMts, AMg2, AMg3, AMg5, AMg6 and GOST 4784-65. (12). From -196 to +150. (13). According to calculation. (14). Pressed from aluminum and aluminum alloys. (15). Aluminum of brands AD0, AD1 and AD and aluminum alloys of brands D1, D6, AVD1-1, V95, AK6, AV, AMts, AMg2, AMg3, AMg5 and AMg6 according to GOST 4784-65 and 4784-65 and 1131-67. (16). Then. (17). Welded from aluminum alloys. (18). Sheet of aluminum alloy according to GOST 13722-68. (19). Copper pulled. (20). Copper of brands M1, M2, M3, M3r according to GOST 859-66 and tombac of brand L96 according to GOST 15527-70. (21). Copper pressed. (22). Copper welded. (23). Copper of brand M3 according to GOST 617-64 and 859-66, sheet according to GOST 495-70. (24). Copper and brass thin-walled. (25). Copper of brands M1, M2, M3 according to GOST 859-66, brass of brands L96, L68, L63 according to GOST 15527-70. (26). Brass pulled. (27). Brass of brands L63, L68, LO70-1, LA77-2, LMSh 68-0.05, LAMsh77-2-0.05 and LOMsh70-1-0.05 according to GOST 15527-70. (28). Brass pressed. (29). Brass of brands L63, LS59-1 and LZhMts59-1-1 according to GOST 15527-70. (30). Brass welded. (31). Brass of brand L63 according to GOST 15527-70, sheet according to GOST 931-70. (32). Bronze pressed. (33). Bronze of brands/marks BrAZhMts10-3-1.5 and BrAZhN10-4-4 according to GOST 493-54. (34). Lead. (35). Lead of brands S0, S1, S2, S3, according to GOST 3778-65.

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Table 2. Ducts circular pulled and pressed from aluminum and aluminum alloys (GOST 1947-56*).

$D_н$, мм	S, мм											
	1	2	3	4	5	6	8	10	15	20	25	30
	(1) Масса 1 пог.м в кг											
10	0,079	0,141	—	—	—	—	—	—	—	—	—	—
14	0,114	0,211	0,290	—	—	—	—	—	—	—	—	—
20	0,167	0,317	0,449	0,563	—	—	—	—	—	—	—	—
25	0,211	0,405	0,581	0,739	0,88	—	—	—	—	—	—	—
32	0,273	0,528	0,765	0,985	1,188	1,372	—	—	—	—	—	—
40	0,343	0,669	0,976	1,267	1,539	1,794	2,252	2,639	—	—	—	—
50	0,431	0,844	1,24	1,619	1,979	2,322	2,956	3,519	4,618	—	—	—
60	0,519	1,02	1,504	1,97	2,419	2,85	3,659	4,398	5,938	—	—	—
70	—	1,196	1,768	2,322	2,859	—	4,363	5,278	7,257	8,797	—	—
80	—	1,372	2,032	2,674	3,299	—	5,067	6,158	8,577	10,56	—	—
90	—	1,548	2,296	3,026	3,738	—	—	7,037	9,896	12,32	14,29	—
100	—	—	2,56	3,378	4,178	—	—	7,917	11,22	14,07	16,49	18,47
120	—	—	—	4,082	5,058	—	—	9,767	13,85	17,59	20,89	23,75
150	—	—	—	—	—	—	—	12,32	17,81	22,87	27,49	31,67
170	—	—	—	—	—	—	—	14,07	20,45	26,39	31,89	36,95
200	—	—	—	—	—	—	—	16,71	24,41	31,67	38,49	44,86
250	—	—	—	—	—	—	—	21,11	31,01	40,46	49,48	58,06
280	—	—	—	—	—	—	—	23,75	34,97	45,74	56,08	65,97

Notes: 1. The mass of ducts in Table 2 is determined in the density, equal to 2.8, which corresponds to the aluminum alloys of brands D1, D16 and AVD1-1.

2. For computing mass of ducts from other alloys should be used coefficients:

for fusion of brand AV ... 0.961;

the same AMg2 ... 0.953;

the same AMg3 ... 0.955;

the same Amg5 ... 0.946;

the same AMg6 ... 0.943;

for fusion of brand AK6 ... 0.982;

the same, V95 ... 1.018;

the same AMts ... 0.975;

For aluminum of ADbrands/marks, AD1, AD0, AD000 ... 0.967.

Key: (1). Mass of 1 lin. m in kg.

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Sizes/dimensions and mass of the pulled and pressed circular ducts for aluminum and aluminum alloys are given in Table 2.

The chemical composition and the mechanical properties of the

metal of ducts from aluminum and aluminum alloys are given in Table 13, chapter I.

2. Ducts and part welded of aluminum conduits/manifolds.

Wrought pipes and parts of aluminum conduits/manifolds prepare from the annealed (M) aluminum sheets (GOST 13722-68) on standards machine-buildings MN 1100-60 - MN 1112-60. They are intended for a work in the permissible on aggressiveness media at temperature from -196 to +120°C and operating pressure 2.5 kg/cm².

During the manufacture of ducts and parts is allowed/assumed any means of weld, which ensures the uniform strength of the weld with base metal.

During the weld of the parts between themselves or with ducts longitudinal welds must be misaligned not less than by 100 mm.

Finished parts and ducts must hold out the testing by hydraulic pressure 4 kg/cm² without the formation of orifice, sweating and bulge.

The enumeration of the standardized parts of conduits/manifolds and their basic dimensions are given in Table 3-8.

Table 3. Enumeration of the standardized parts of conduits/manifolds from aluminum alloys on $P_{раб}=2.5$ kg/cm² from D_y from 100 to 1000 mm.

(1) Наименование	(2) Номер нормали	(3) Номер таблицы в данной главе
(4) Трубы сварные	МН 1100-60	4
(5) Полусекторы сварные под углом:		
15°	МН 1101-60	5
22°30′	МН 1102-60	5
(6) Секторы сварные под углом:		
30°	МН 1103-60	5
45°	МН 1104-60	5
(7) Отводы сварные под углом:		
30°	МН 1105-60	6
45°	МН 1106-60	6
60°	МН 1107-60	6
90° трехсекторные (8)	МН 1108-60	6
90° четырехсекторные (9)	МН 1109-60	6
(10) Отводы продольносварные под углом 90° (с D_y от 100 до 500 мм)	МН 1110-60	7
(11) Переходы сварные	МН 1111-60	8
(12) Технические требования	МН 1112-60	—

Key: (1). Designation. (2). Number of standard. (3). Number of table in this chapter. (4). Ducts welded. (5). Half-sectors (welded at angle). (6). Sectors (welded at angle). (7). Offtakes (welded at angle). (8). three-sector. (9). four-sector. (10). Offtakes longitudinally welded at angle of 90° (from D_y from 100 to 500 mm). (11). Transitions welded. (12). Technical requirements.

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Table 4. Ducts welded from aluminum alloys on $P_{раб}=2,5$ kg/cm² (MN 1100-60).

(1) Размеры в мм				(2) Масса 1 пог.м в кг
D_y	$D_н$	(3) допускаемые отклонения $D_н$	s	
100	103	−1	1,5	1,32
125	128			1,63
150	153			1,95
200	203			2,65
250	254		2	4,5
300	306	−1,5	2,5	6,5
350	355			7,6
400	406		3	10,4
450	456			11,6
500	506			13
600	608		4	21
700	708	−3		24,2
800	810		5	34,6
1000	1012		6	82

Note. Length of ducts - according to agreement with customer.

Key: (1). Sizes/dimensions in mm. (2). Mass of 1 lin. m in kg. (3). manufacturing tolerances.

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Table 5. Half-sectors and sectors are welded from aluminum alloys on

$P_{раб}=2,5$ kg/cm².

(1) Полусекторы

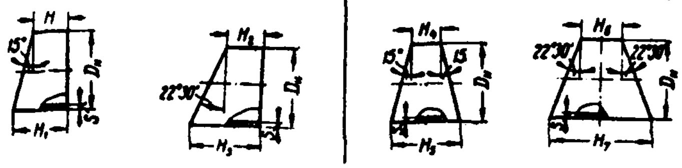
(3) под углом скоса 15° (МН 1101-60)

(3) под углом скоса 22°30' (МН 1102-60)

(2) Секторы

(3) под углом скоса 30° (МН 1103-60)

(3) под углом скоса 45° (МН 1104-60)



(4) Размеры в мм											(5) Масса в кг			
D_y	$D_н$	S	H	H_1	H_2	H_3	H_4	H_5	H_6	H_7	полусектора (6) 15°	полусектора (6) 22°30'	сектора (7) 30°	сектора (7) 45°
100	103	1,5	53	81	68	111	55	110	86	170	0,09	0,12	0,11	0,17
125	128	1,5	60	96	74	125	65	124	85	190	0,13	0,17	0,15	0,23
150	153		58	99	76	138	70	152	108	234	0,15	0,22	0,22	0,34
200	203		69	123	90	171	80	189	123	288	0,26	0,35	0,36	0,5
250	254	2	73	141	99	199	95	231	147	355	0,48	0,66	0,73	1,1
300	305	2,5	78	159	107	231	110	273	170	420	0,77	1,11	1,25	1,9
350	355		84	179	116	261	120	310	185	476	1	1,44	1,56	2,5
400	406	3	95	204	130	297	130	348	201	534	1,56	2,24	2,48	3,8
450	456		106	228	144	331	140	384	215	589	1,97	2,73	3,1	4,7
500	506		97	252	156	363	150	421	232	640	2,1	3,3	3,75	5,6
600	608	4	114	277	164	413	170	496	262	762	4,12	6,12	7	10,5
700	708		123	313	180	470	200	580	309	889	5,28	8,1	9,44	14,4
800	810	5	145	362	209	541	230	654	339	1003	8,75	13	15,2	23
1000	1012	6	163	428	244	680	260	822	432	1262	15,5	23,9	28,9	43,7

Key: (1). Half-sectors. (2). Sectors. (3). at angle of bevel. (4). Sizes/dimensions in mm. (5). Mass in kg. (6). half-sector. (7). sector.

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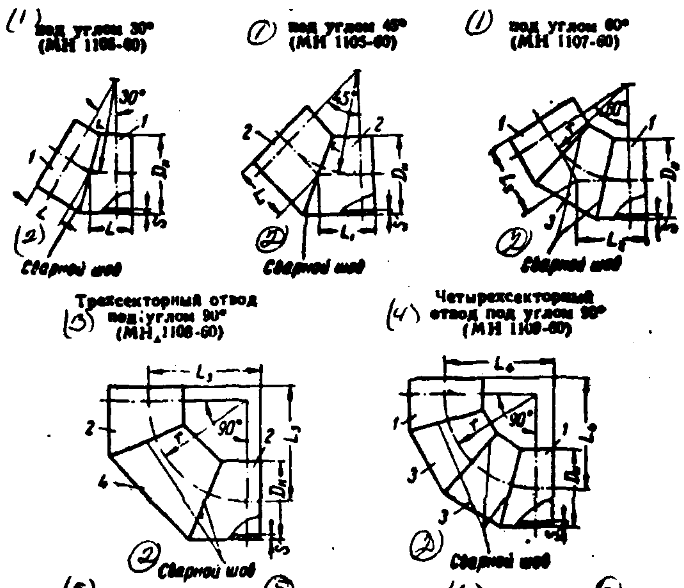
Table 6. Offtakes are welded from aluminum alloys on $P_{раб}$=2,5 kg/cm^2.



1 — полусектор 15°; 2 — полусектор 22°30′; 3 — сектор 30°; 4 — сектор 45°

continuation Table 6.

(7) Размеры в мм									(8) Масса отвода в кг				
												90°	
D_y	$D_н$	S	r	L	L_1	L_2	L_3	L_4	30°	45°	60°	(9) трехсекторного	(10) четырехсекторного
100	103	1,5	154	67	93	115	180	180	0,18	0,24	0,29	0,41	0,4
125	128		167	77	100	129	200	200	0,26	0,34	0,41	0,57	0,56
150	153		207	78	107	142	225	230	0,3	0,44	0,52	0,78	0,74
200	203		251	96	131	174	280	280	0,52	0,7	0,88	1,2	1,24
250	254	2	301	107	151	202	330	330	0,96	1,36	1,69	2,42	2,42
300	305	2,5	358	118	169	229	380	380	1,44	2,22	2,69	4,12	3,94
350	355		401	131	189	255	425	425	2	2,88	3,56	5,38	5,12
400	406	3	445	150	213	288	475	475	3,12	4,48	5,6	8,28	8,06
450	456		489	167	237	318	525	525	3,94	5,46	7,04	10,16	10,1
500	506		533	165	259	330	575	555	4,2	6,6	7,96	12,2	11,7
600	608	4	621	195	288	388	656	650	8,24	12,24	15,22	22,74	[illegible]
700	708		727	218	325	443	755	750	10,56	16,2	20	30,6	[illegible]
800	810	5	815	251	375	506	850	850	17,6	26	[illegible]	[illegible]	[illegible]
1000	1012	6	1028	298	452	616	1055	1050	31	47,81	59,9	[illegible]	[illegible]

Key: (1). at angle of 30° (MN 1105-60). (2). Weld. (3). Three-sector offtake at angle of 90° (MN 1108-60). (4). Four-sector offtakes at an angle of 90° (MN 1109-60) (5). half-sector. (6). sector. (7). Sizes/dimensions in mm. (8). Mass of offtake in kg. (9). three-sector. (10). four-sector.

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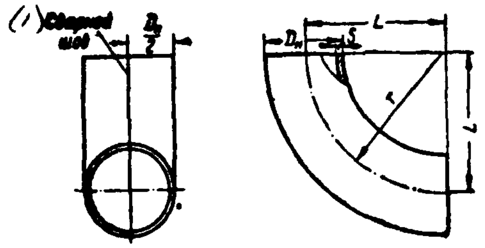
Table 7. Offtakes longitudinally welded from aluminum alloys at angle of 90° on $P_{раб}=2{,}5$ kg/cm². (МН 1110-60).



(2) Размеры в мм				(3) Масса в кг
D_y	$D_н$	S	$r=L$	
100 125 150 200	103 128 153 203	1,5	180 200 230 280	0,4 0,52 0,72 1,15
250	254	2	330	2,3
300 350	305 355	2,5	380 425	3,9 5,08
400 450 500	406 456 506	3	475 525 555	7,6 9,7 11,4

Key: (1). The weld. (2). Sizes/dimensions in mm. (3). Mass in kg.

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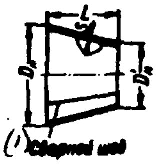
Table 8. Transitions welded from aluminum alloys on $P_{раб}=2,5$ kg/cm² (MN 1111-60).



$D_y \times D'_y$	$D_н$	$D'_н$	S	L	(3) Масса в кг
(2) Размеры в мм					
125×100	128	103	1,5	48	0,07
150×100	153	103		95	0,15
150×125		128		48	0,1
200×125	203			140	0,31
200×150		153		95	0,24
250×125	254	128	2	285	0,7
250×150		154		190	0,57
250×200		204		95	0,33
300×150	305	155	2,5	280	1,12
300×200		205		190	0,86
300×250		255		95	0,57
350×200	355	205		280	1,36
350×250		255		190	1,1
350×300		305		95	0,7
400×250	406	256	3	280	2,08
400×300		306		190	1,7
400×350		356		95	0,85
450×300	456	306		280	2,5
450×350		356		190	1,9
450×400		406		95	1,1
500×350	506	356		280	2,8
500×400		406		190	2,31
500×450		456		95	1,2
600×400	608	408	4	375	5,9
600×450		458		280	4,5
600×500		508		190	3,26
700×450	708	458	4	470	8,85
700×500		508		375	6,76
700×600		608		190	4,36
800×500	810	510	5	560	12,8
800×600		610		375	10,7
800×700		710		190	5,6
1000×600	1012	612	6	780	29,5
1000×700		712		560	23,2
1000×800		812		375	17,4

Key: (1). The weld. (2). Sizes/dimensions in mm. (3). Mass in kg.

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§3. Ducts and parts of conduits are copper.

1. Ducts copper pulled and pressed.

Ducts copper of general purpose prepare pulled, cold-rolled and pressed from copper of brands M1, M2, M3 and M3r according to GOST 859-66 and from tombac of brand L96 according to GOST 15527-70 only by pulled ones in diameter to 30 mm inclusively.

Ducts pulled and cold-rolled due to the state of material supply soft (annealed) - M and solid (cold-worked) - T of the following sizes/dimensions in mm:

the outside diameter: 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 22; 23; 24; 25; 26; 28; 30; 32; 34; 35; 36; 38; 40; 42; 45; 48; 50; 53; 55; 58; 60; 63; 65; 68; 70; 75; 80; 85; 90; 95; 100; 104; 105; 106; 107; 108; 110; 114; 115; 116; 120; 122; 124; 125; 128; 129; 130; 131; 132; 135; 137; 139; 144; 145; 146; 150; 155; 156; 157; 158; 160; 165; 166; 168; 170; 180; 181; 182; 183; 185; 189; 200; 206; 207; 208; 210; 212; 214; 231; 232; 233; 235; 239; 250; 258; 260; 282; 283; 300; 307; 308; 310; 315; 332; 350; 357; 358; 360;

the wall thickness: 0.5; 0.6; 0.8; 1; 1.2; 1.5; 2; 2.5; 3; 3.5; 4; 4.5; 5; 6; 7; 8; 10.

Ducts pressed supply by the sizes/dimensions:

the outside diameter: 30; 32; 34; 36; 38; 40; 42; 45; 46; 50; 55; 60; 65; 70; 75; 80; 85; 90; 95; 100; 105; 110; 115; 1 0; 125; 130; 135; 140; 145; 150; 155; 160; 165; 170; 175; 180; 185; 190; 195; 200; 210; 220; 230; 240; 250; 260; 270; 280.

the wall thickness; 5; 6; 7; 7.5; 8; 8.5; 10; 12.5; 15; 17.5; 20; 22.5; 25; 27.5; 30.

Sizes/dimensions and mass of the frequently used copper ducts are given in Table 9.

The chemical composition of copper ducts is given in Table 13 of chapter I, the mechanical properties of the material of ducts are given in Table 10.

Table 9. Ducts copper pulled and pressed (GOST 617-64*).

$D_н$, мм	S, мм									
	1	2	3	4	5	10	15	20	25	30
	(1) Масса 1 пог. м трубы в кг									
10	0,25	0,45	—	—	—	—	—	—	—	—
14	0,36	0,67	0,92	—	—	—	—	—	—	—
20	0,53	1,01	1,43	1,79	2,09	—	—	—	—	—
25	0,67	1,29	1,84	2,34	2,79	—	—	—	—	—
32	0,87	1,68	2,43	3,13	3,77	—	—	—	—	—
40	1,09	2,12	3,1	4,02	4,89	8,38	—	—	—	—
50	1,37	2,68	3,94	5,14	6,29	11,18	14,67	—	—	—
60	1,65	3,24	4,78	6,26	7,69	13,97	18,86	—	—	—
70	—	3,8	5,62	7,38	9,08	16,77	23,06	—	—	—
80	—	4,36	6,46	8,5	10,48	19,56	27,25	33,53	—	—
90	—	—	—	—	11,88	22,36	31,44	39,12	45,41	—
100	—	5,48	8,13	10,73	13,27	25,16	35,63	44,71	52,4	58,68
120	—	—	—	—	16,07	30,74	44,01	55,89	66,37	73,45
150	—	—	—	—	20,26	39,12	56,59	72,65	87,33	100,6
170	—	—	—	—	23,06	44,71	64,97	83,83	100,3	117,4
200	—	—	—	—	—	53,09	77,65	100,6	122,3	142,5
250	—	—	—	—	—	67,07	98,5	128,6	157,2	184,4
280	—	—	—	—	—	75,45	—	154,3	—	209,6

Note. With computation the density of copper and brass (tombac) of brand L96 are taken equal to 8, 9.

Key: (1). Mass of 1 lin. m of duct in kg.

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Depending on designation/purpose the supplied ducts test for flattening, for edging and for hydraulic pressure, determined according to the formula

$$P = \frac{1100S}{D_в},$$

where S - wall thickness in mm; D_{B} - bore in mm.

2. Ducts and part welded of copper conduits/manifolds.

Wrought pipes in outside diameter 410-510 mm and parts of copper conduits/manifolds prepare from sheet (GOST 495-70) copper of brand M3 (GOST 859-66 and GOST 617-64*) on the standards of machine-building MN 1138-60 - MN 1166-60. They are intended for a work in the permissible on aggressiveness media at temperature from -196 to +120°C and operating pressure 6 kg/cm².

During the manufacture of ducts and parts is allowed/assumed any means of weld, which ensures the uniform strength of the weld with base metal.

During the weld of the parts between themselves or with ducts longitudinal welds must be misaligned not less than by 100 mm.

Finished parts and ducts must age by hydraulic pressure test according to technical specifications without the formation of orifice, sweating and swelling.

The enumeration of the standardized parts of conduits/manifolds and their basic dimensions are given in Table 11-21.

Table 10. Mechanical properties of ducts from the brands/marks of copper M1, M2, M3, M3r and brass L96 (GOST 617-64*).

(1) Состояние поставки труб	$\sigma_в$, кгс/мм² (2)	δ_{10}, %
	(3) не менее	
(4) Тянутые или холоднокатаные (М)	21	35
(5) Прессованные	19	30

Key: (1). As-received condition of ducts. (2). kg/mm². (3). it is not less. (4). Pulled or are cold-rolled (M). (5). Pressed.

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Table 11. Enumeration of the standardized parts of conduits/manifolds from copper on $P_{раб}=6$ kg/cm².

(1) Наименование	D_y, мм	(2) Номер нормали	(3) Номер таблицы в данной главе
(4) Трубы сварные	400—500	МН 1138-60	12
(5) Полусекторы сварные под углом:			
15°	100—500	МН 1139-60	13
22°30′	100—500	МН 1140-60	13
(6) Секторы под углом 30°	100—500	МН 1141-60	13
(7) Отводы сварные под углом:			
30°	100—500	МН 1142-60	14
45°	100—500	МН 1143-60	14
60°	100—500	МН 1144-60	14
90°	100—500	МН 1145-60	14
(8) Переходы сварные	100—500	МН 1146-60	15
(9) Тройники сварные:			
(9a) прямые	100—350	МН 1147-60	16
(9b) переходные	100—350	МН 1148-60	17
(9c) под углом 45°	100—350	МН 1149-60	18
(10) Отводы сварные со свободными фланцами под углом*:			
30°	100—500	МН 1150-60	—
45°	100—500	МН 1151-60	—
60°	100—500	МН 1152-60	—
90°	100—500	МН 1153-60	—
(11) Отводы гнутые со свободными фланцами под углом:			
30°	20—80	МН 1154-60	19
45°	20—80	МН 1155-60	19
60°	20—80	МН 1156-60	19
90°	20—80	МН 1157-60	19
(12) Переходы сварные со свободными фланцами*	100—500	МН 1158-60	—
(13) Тройники сварные со свободными фланцами*:			
(13a) прямые	100—350	МН 1159-60	—
(13b) переходные	100—350	МН 1160-60	—
(13c) под углом 45°	100—350	МН 1161-60	—
(14) Бортшайбы для труб:			
(14a) типа I	100—500	МН 1162-60	20
» II	20—80	МН 1163-60	20
(15) Фланцы стальные свободные с бортшайбами:			
(15a) приварными	100—500	МН 1164-60	21
(15b) припаянными	20—80	МН 1165-60	21
(16) Технические требования*	—	МН 1166-60	—

Notes: 1. The supplied articles must be passivated and covered with outside anticorrosive clear varnish. Steel parts must be painted.

2. To parts, noted by chain wheel, standards in handbook are not given.

Key: (1). Designation. (2). Number of standard. (3). Number of table in this chapter. (4). Ducts (welded. (5). Half-sectors (welded at angle). (6). Sectors at angle. (7). Offtakes (welded at angle). (8). Transitions (welded. (9). T-connections (welded. (9a). straight lines. (9b). transitional. (9c). at angle. (10). Offtakes welded with slip-on flanges at angle. (11). Offtakes, bent with slip-on flanges at angle. (12). Transitions welded with slip-on flanges. (13). T-connections welded with slip-on flanges. (14). edge washers for ducts. (14a). type. (15). Flanges steel free with edge washers. (15a). welded. (15b). soldered. (16). Technical requirements.

Table 12. Ducts welded copper on $P_{раб}=6$ kg/cm² (MH 1138-60).

(1) Размеры в мм			(2) Масса 1 пог. м в кг
D_y	$D_н$	S	
400 450 500	410 460 510	5	56,7 63,6 70,5

Note. Length of ducts - according to agreement with customer.

Key: (1). Sizes/dimensions in mm. (2). Mass of 1 lin. m in kg.

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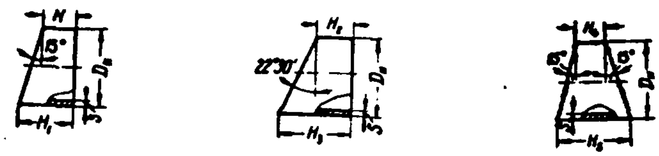
Table 13. Half-sectors and sectors welded copper on $P_{раб}=6$ kg/cm².

(1) Полусекторы:

(2) Под углом 15° (МН 1139-60) (2) Под углом 22°30′ (МН 1140-60) (3) Сектор под углом 30° (МН 1141-60)



(4) Размеры в мм									(5) Масса в кг		
$D_у$	$D_н$	S	H	H_1	H_2	H_3	H_4	H_5	(6) полусектора 15°	(6) полусектора 22°30′	(7) сектора 30°
100 125 150	105 130 155	2,5	53 60 55	81 96 97	63 69 71	107 123 135	55 55 70	111 125 154	0,46 0,69 0,83	0,61 0,86 1,1	0,6 0,8 1,2
200	206	3	64	119	79	164	80	190	1,63	2,1	2,3
250 300 350	258 308 358	4	74 79 83	143 162 179	86 99 107	196 226 255	95 110 120	233 276 312	3,08 4 5,21	4 5,5 7,2	4,67 6,55 8,53
400 450 500	410 460 510	5	92 97 99	202 220 236	115 128 134	285 313 335	130 140 150	350 386 404	8,45 10,88 11,5	11,3 13,9 16,2	13,65 16,7 20,5

Key: (1). Half-sectors. (2). at angle. (3). Sector at angle. (4). Sizes/dimensions in mm. (5). Mass in kg. (6). half-sector. (7). sector.

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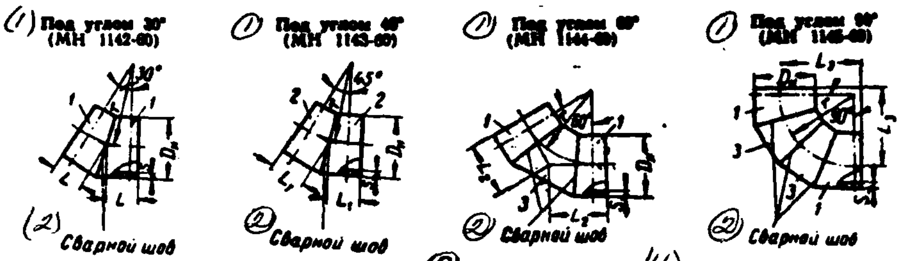
Table 14. Offtakes welded copper on $P_{раб}=6$ kg/cm^2.



(3) 1 — полусектор 15°; 2 — (3) полусектор 22°30'; 3 — (4) сектор 30°

(5) Размеры в мм								(6) Масса в кг отвода под углом			
D_y	$D_н$	S	r	L	L_1	L_2	L_3	30°	45°	60°	90°
100 125 150	105 130 155	2,5	155 168 208	67 77 76	85 95 103	114 129 140	180 200 228	0,96 1,38 1,66	1,22 1,72 2,2	1,56 2,18 2,86	2,16 2,98 4,06
200	206	3	252	92	121	169	276	3,28	4,2	5,56	7,86
250 300 350	258 308 358	4	306 359 403	108 120 131	142 163 181	202 231 256	332 383 426	6,06 8 10,42	8 11 14,4	10,73 14,55 18,96	15,4 21,1 27,48
400 450 500	410 460 510	5	448 491 535	147 159 167	200 218 229	285 311 333	475 518 559	16,9 21,64 23	22,6 27,8 32,4	30,6 37,74 43,5	44,1 54,44 64

Key: (1). at angle. (2). Weld. (3). half-sector. (4). sector. (5). Sizes/dimensions in mm. (6). Mass in kg. of offtake at angle.

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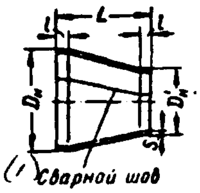
Table 15. Transitions welded copper on $P_{раб}=6$ kg/cm² (МН 1146-60).



	(2) Размеры в мм					(3) Масса в кг
$D_y \times D_y$	L	l	$D_н$	$D_н$	S	
125×100	80	18	130	105	2,5	0,67
150×100	138	30	155			1,26
150×125	88	26		130		0,88
200×125	206	50	206	131	3	2,87
200×150	154	44		156		2,32
250×150	265	58	258	158	4	5,99
250×200	148	40		208		3,87
300×200	249	48	308			6,18
300×250	140	32		258		4,49
350×200	357	62	358	208		11,2
350×250	218	47		258		7,80
350×300	144	36		308		5,39
400×250	347	48	410	260	5	16,25
400×300	263	58		310		13,16
400×350	146	34		360		7,96
450×250	430	39	460	260		21,93
450×300	[illegible]	[illegible]		310		18,57
450×350	241	39		360		14,11
450×400	[illegible]	35		410		8,75
500×300	422	31	510	310		24,67
500×350	330	31		360		20,38
500×400	214	43		410		15,79
500×450	112	34		460		9,72

Key: (1). The weld. (2). Sizes/dimensions in mm. (3). Mass in kg.

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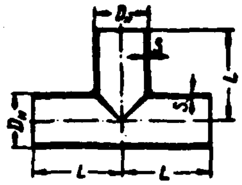
Table 16. T-connections welded copper straight lines on $P_{раб}=6$ kg/cm² (MN 1147-60).



(1) Размеры в мм				(2) Масса в кг
D_y	L	$D_н$	S	
100 125 150	155 180 218	105 130 155	2,5	2,76 3,93 5,74
200	226	206	3	8,9
[illegible] [illegible] [illegible]	272 318 341	[illegible] [illegible] [illegible]	4	[illegible] 24,2 [illegible]

Note. Material - duct pulled is soft from copper of brand M3 according to GOST 617-64*.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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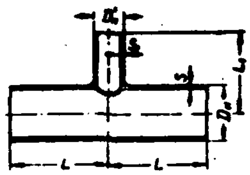
Table 17. T-connections welded copper transitional on $P_{раб}=6$ kg/cm² (MN 1148-60).

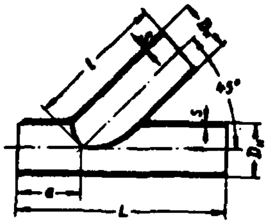


(1) Размеры в мм							(2)
$D_y \times D'_y$	L	L_1	$D_н$	S	$D'_н$	S_1	Масса в кг
125×100	180	165	130	2,5	105	2,5	3,6
150×100	216	195	155				5,38
150×125					130		5,45
200×100	226	210	206	3	105		8,35
200×125					130		8,45
200×150		220			155	2,0	8,9
250×125	272	245	258	4	130		16,38
250×150		253			155		16,48
250×200		251			206	3	17
300×150	318	278	308		155	2,5	22,72
300×200		301			206	3	23,65
300×250		322			258	4	26,1
350×200	341	326	358		206	3	30,8
350×250		347			258	4	30,5
350×300		343			308		30,9

Note. Material - duct pulled is soft from copper of brand M3 according to GOST 617-64*.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

Table 18. T-connections welded copper at angle of 45° on $P_{раб}=6$ kg/cm² (MN 1149-60).



(1) Размеры в мм						(2) Масса в кг
D_y	L	l	a	$D_н$	S	
100	310	260	55	105	2,5	3,15
125	360	300	70	130		4,45
150	436	328	98	155		6,12
200	552	401	96	206	3	11,94
250	674	472	112	[illegible]	4	23,6
300	706	538	153	308		32,25
350	832	606	151	358		39,5

Note. Material - duct pulled is soft from copper of brand M3 according to GOST 617-64*.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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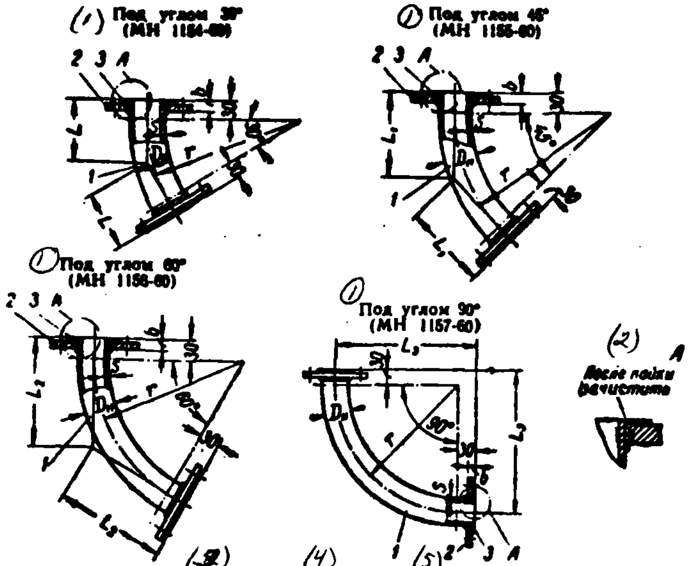
Table 19. Offtakes the bent copper with slip-on flanges on

$P_{раб}=6$ kg/cm².



(3) 1 — отвод; (4) 2 — фланец; (5) 3 — бортшайба

(6) Размеры в мм									(7) Масса в кг отвода под углом			
D_y	r	$D_н$	S	b	L	L_1	L_2	L_3	30°	45°	60°	90°
20	100	22	1,5	12,5	57	72	88	130	1,02	1,05	1,07	1,12
25 32 40 50	125 160 200 250	28 35 45 55		15	64 73 84 97	82 96 113 134	102 122 145 174	155 190 230 280	1,49 2,12 2,49 2,89	1,53 2,18 2,59 3,04	1,56 2,24 2,68 3,18	1,63 2,36 2,87 3,5
70 80	[illegible] 400	76 [illegible]	2	17,5	[illegible] 137	175 [illegible]	[illegible] [illegible]	[illegible] [illegible]	4,46 7,23	4,83 7,71	5,21 8,2	5,95 9,16

Notes: 1. Material - duct pulled is soft from copper of brand M3 (GOST 617-64*).

2. Soldering of edge washers see on drawing. To braze PMTs 54 according to GOST 1534-42. Is allowed/assumed the replacement of the brand/mark of solder depending on the properties of transported product.

Key: (1). at angle. (2). After soldering to clean. (3). offtake. (4). flange. (5). edge washer. (6). Sizes/dimensions in mm. (7). Mass in kg. of offtake at angle.

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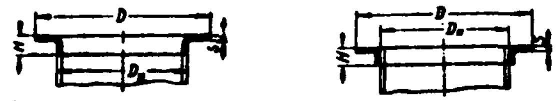
Table 20. Edge washers are copper for ducts on $P_{раб} = 6$ kg/cm².

(1) Тип I для труб с D_y = 100 ÷ 500 мм (МН 1162-60)   (1) Тип II для труб с D_y = 20 ÷ 80 мм (МН 1163-60)



(2) Труба		(3) Бортшайба			(5) Масса в кг
(4) размеры в мм					
D_y	$D_н$	D	H	S	
20	23	50	12	2,5	0,04
25	29	60	15	3	0,07
32	36	70			0,1
40	46	80	18		0,13
50	56	90			0,15
70	76	110	20	3,5	0,24
80	86	128			0,33
100	105	148			0,48
125	130	178		4	0,64
150	155	202	22		0,76
200	206	258	24		1,11
250	258	312	28	5	1,85
300	308	363	32		2,40
350	358	415	34		3
400	410	465	40	6	4,31
450	460	520	42		5,22
500	510	570	46		6,1

Key: (1). Type 1 for ducts from. (2). Duct. (3). edge washer. (4). sizes/dimensions in mm. (5). Mass in kg.

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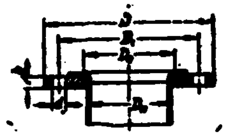
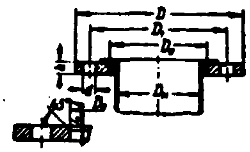
Table 21. Flanges steel free for copper ducts with welded or soldered edge washers on $P_{раб}=6$ kg/cm².

(1) Для труб с D_y=100÷500 мм с приварными бортшайбами (МН 1164-60)



(1) Для труб с D_y=20÷80 мм с припаянными бортшайбами (МН 1165-60)



(2) Труба		(3) Фланец						
	(4) размеры в мм						(5) количество отверстий	(6) Масса в кг
D_y	$D_н$	D	D_0	D_1	b	d		
20	23	90	27	65	10	12	4	0,42
25	29	100	37	75	12			0,6
32	36	120	45	90		14		0,86
40	46	130	55	100				0,97
50	56	140	65	110				1,02
70	76	160	87	130	14			1,06
80	86	185	97	150		18		1,45
100	106	205	109	170				2,5
125	130	235	135	200			8	3
150	155	260	160	225	16			3,8
200	206	315	212	280	18			5,8
250	258	370	264	335	20		12	7,8
300	308	435	314	395	24	23	12	12,3
350	358	485	364	445	26			16,6
400	410	535	416	495	32		16	20,6
450	460	590	466	550	34			25,6
500	510	640	516	600	38			31,0

notes: 1. The sizes/dimensions of flanges, with exception of the bore D_0, correspond to GOST 1272-67.

2. Material - steel or brand St.3 according to GOST 380-71.

Key: (1). For ducts from with welded edge washers . (2). Duct. (3). Flange. (4). sizes/dimensions in mm. (5). quantity of holes. (6). Mass in kg.

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3. Tubes copper and brass thin-walled (GOST 11383-65).

Tubes copper and brass thin-walled prepare from copper of brands M1, M2, M3 (GOST 859-66) and brass of brands L96, L68 and L63 (GOST 15527-70) the following sizes/dimensions in mm:

the outside diameter: 1.5; 1.6; 2; 2.2; 2.4; 2.6; 2.8; 3; 3.2; 3.4; 3.6; 3.8; 4; 4.5; 4.8 5; 6; 7; 7.5; 8; 8.5; 9; 9.5; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 24; 28;

the wall thickness: 0.15; 0.2; 0.25; 0.3; 0.35; 0.4; 0.45; 0.5; 0.6; 0.65; 0.7.

Due to the state of the material of tube they supply: solid (not annealed) from copper and brass of brand L96, solid after low-temperature annealing of brass of brands L63 and L68 and soft (annealed) with the ratio of diameter to wall thickness not more than 20.

Depending on designation/purpose the tubes prepare the common and increased precision/accuracy.

Tubes supply by length from 1 to 3 m, and with $D_н$ mm can be supplied in bays.

The computation of mass 1 lin. m of tubes determine from the formula

$$G = \frac{\pi\gamma}{1000}(D_н - S)S,$$

where γ - the density of metal, taken for copper and brass of brand L96-8.9; for brass of brand L68-8.6 and for brass of brand L63-8.5;

$D_н$ - outside diameter of tube in mm;

S - wall thickness in mm.

The chemical composition of the metal of tubes is given in Tables 13 and 15, chapter 1, and mechanical properties are given in Table 22.

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§4. Ducts and parts of conduits/manifolds are brass.

1. Ducts brass pulled and pressed (GOST 494-69).

Ducts brass prepare pulled and pressed.

Due to the state of material pulled ducts supply soft (M) - annealed and semi-solid (ПТ) - after low-temperature annealing. Sizes/dimensions of pulled ducts in mm:

the outside diameter: 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 34; 35; 36; 37; 38; 40; 42; 45; 46; 47; 48; 50; 51; 52; 54; 55; 58; 60; 64; 65; 70; 75; 76; 80; 86; 90; 93; 96; 97; 100.

the wall thickness: 0.5; 0.75; 1; 1.5; 2; 2.5; 3; 3.5; 4; 4.5; 5; 6; 7; 8; 10.

The pressed ducts supply by sizes/dimensions in mm:

the outside diameter: 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 42; 43; 45; 46; 47; 48; 50; 51; 52; 53; 54; 55; 58; 59; 60; 63; 65; 68; 70; 72; 73; 75; 80; 85; 90; 92; 95; 100; 105; 110; 112; 115; 120; 123; 125; 130; 135; 140; 145; 150; 155; 160; 165; 170; 175; 180; 185; 190; 195.

the wall thickness: 1.5; 2; 2.5; 3; 3.5; 4; 4.5; 5; 5.5; 6; 6.5; 7; 7.5; 8; 8.5; 9; 10; 11.5; 12.5; 14; 15; 17.5; 20; 22.5; 25; 27.5; 30; 32.5; 35; 37.5; 42.5.

Sizes/dimensions and mass of the frequently used brass ducts are given in Table 23.

The chemical composition and mechanical properties of the metal of brass ducts are given in Table 15, chapter I.

Ducts are tested with hydraulic pressure 50 kg/cm^2, and also on extension and flattening.

Table 22. Mechanical of tae properties of the metal of tubes.

(1) Марка металла или сплава	$\sigma_в$, кгс/мм² (2)	δ_{10}, %
	(3) не менее	
	(4) Трубки мягкие	
M1, M2, M3, Л96	21	35
Л63, Л68	30	38
	(5) Трубки твердые	
M1, M2, M3, Л96	35	2
Л63, Л68	40	10

Key: (1). Brand/mark of metal or alloy. (2). kg/mm². (3). it is not less. (4). Tubes (soft. (5). Tuoes (solid.

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2. Ducts and part of brass conduits/manifolds.

Wrought pipes and parts of brass conduits/manifolds to operating pressure 6 kg/cm² prepare from latten brass of brand L63 (GOST [ГОСТ - All-union State Standard] 15527-70 and GOST 931-70) on the standards of machine-building MN 113-60 - MN 1124-60, but the parts of conduits/manifolds to operating pressure 200 kg/cm² - from brass of brand L63, LZhMts59-1-1 and LS59-1 (GOST 15527-70) on the standards of machine-building MN1125-60 - MN 1134-60. Ducts and parts are intended for a work in the permissible on aggressiveness media at temperature from -196° to +120°C.

During the manufacture of ducts and parts allow/assume any form the welds, which ensures the uniform strength of the weld with base metal.

During the weld of the parts between themselves or with ducts longitudinal welds must be misaligned not less than by 100 mm.

Ducts and parts of conduits/manifolds with operating pressure 6 kg/cm^2 test to test hydraulic pressure 9 kg/cm^2, but with operating pressure 200 kg/cm^2 - to test pressure 300 kg/cm^2.

The enumeration of the standardized parts of conduits/manifolds and their basic dimensions are given in Tables 4, 5, 6, 7, 8, 24, 25, 26, 27, 28, 29.

Table 23. Ducts brass pulled and pressed (GOST 494-69).

$D_н$, мм	S, мм									
	1	2	3	4	5	10	15	20	25	30
	(1) Масса в кг 1 пог. м трубы при плотности латуни 8,5									
10	0,24	0,43	—	—	—	—	—	—	—	—
14	0,35	0,64	—	—	—	—	—	—	—	—
20	0,51	0,96	1,35	1,71	2	—	—	—	—	—
25	0,64	1,23	1,76	2,24	2,67	—	—	—	—	—
32	0,83	1,6	2,32	2,99	3,6	—	—	—	—	—
40	1,04	2,03	2,96	3,84	4,67	8,01	—	—	—	—
50	1,31	2,56	3,76	4,91	6,01	10,6	14,01	—	—	—
60	1,57	3,1	4,56	5,98	7,34	13,34	18,01	—	—	—
70	—	3,63	5,36	7,06	8,67	16,01	22,02	—	—	—
80	—	4,16	6,15	8,11	10,01	18,68	26,02	32,02	—	—
90	—	—	6,97	9,16	11,34	21,35	30,02	37,36	43,37	—
100	—	—	7,77	10,25	12,71	24,02	34,03	42,7	50,04	56,04
120	—	—	—	—	—	29,36	42,03	53,36	63,38	72,06
150	—	—	—	—	—	37,36	54,04	69,39	83,4	96,08
170	—	—	—	—	—	42,7	62,05	80,06	96,74	112,1

Key: (1). Mass in kg. 1 lin. m of duct at the density of brass 8.5.

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Table 24. Enumeration of the standardized parts of conduits/manifolds from brass on $P_{раб}=6$ and 200 kg/cm².

(1) Наименование деталей	(2) $P_{раб}$ кгс/см²	D_y мм	(3) Номер нормали	(4) Номер таблицы в данной главе
Трубы сварные (5)	6	100—1000	МН 1113-60	4
Полусекторы сварные под углом: (6)				
15°	6	100—1000	МН 1114-60	5
(7) 22°30'	6	100—1000	МН 1118-60	5
Секторы сварные под углом:				
30°	6	100—1000	МН 1115-60	5
(8) 45°	6	100—1000	МН 1119-60	5
Отводы сварные под углом:				
30°	6	100—1000	МН 1116-60	6
45°	6	100—1000	МН 1120-60	6
60°	6	100—1000	МН 1117-60	6
90° трехсекторные (9) . . .	6	100—1000	МН 1121-60	6
90° четырехсекторные (10) .	6	100—1000	МН 1122-60	6
(11) Отводы продольносварные под углом 90°	6	100—500	МН 1123-60	7
(12) Переходы сварные	6	100—1000	МН 1124-60	8
(13) Отводы гнутые под углом 90°	200	10—50	МН 1125-60	25
Переходы (14)	200	10—50	МН 1126-60	26
Тройники: (15)				
(16) прямые	200	10—50	МН 1127-60	27
(17) переходные	200	10—50	МН 1128-60	28
(18) с двумя переходами . .	200	10—50	МН 1129-60	29
Соединения штуцерно-торцовые* (19)	200	4—10	МН 1130-60	—
Штуцера* (20)	200	4—10	МН 1131-60	—
Ниппели* (21)	200	4—10	МН 1132-60	—
Гайки накидные* (22)	200	4—10	МН 1133-60	—
Прокладки фибровые* (23) .	200	4—10	МН 1134-60	—
Технические требования (24) .	—	—	МН 1135-60 — МН 1137-60	—

Notes: 1. The sizes/dimensions of wrought pipes and parts of conduits/manifolds from brass on MN 1113-60 - MN 1124-60 correspond to the sizes/dimensions of the parts of conduits/manifolds from

aluminum alloys on MN 1100-60 - MN 1111-60 (table 4, 5, 6, 7, 8), besides the brass parts from D_y-MM for which wall thickness is accepted by 4.5 mm instead of 4 mm for aluminum ones.

During the determination of the mass of brass parts to accept K=3.05 to the appropriate mass of parts from aluminum alloys.

2. On part, noted by asterisk

standards in handbook are not given (except MN 1130-60).

Key: (1). Designation of parts. (2). kg/cm². (3). Number of standard. (4). Number of table in this chapter (5). Ducts (welded.) (6). Half-sectors (welded at angle). (7). Sectors (welded at angle). (8). Offtakes (welded at angle). (9). three-sector. (10). four-sector. (11). Offtakes longitudinally (welded at angle). (12). Transitions (welded.) (13). Offtakes, bent at angle. (14). Transitions. (15). T-connections. (16). straight lines. (17). transitional. (18). with two transitions. (19). Connections (end-type.) (20). Connecting pipe. (21). Nipples. (22). Nuts (cover.) (23). Plies (fiber.) (24). Technical requirements.

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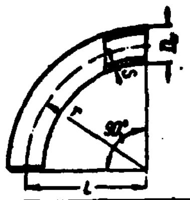
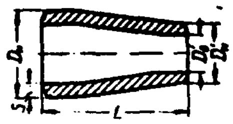
Table 25. Offtakes the bent brass at angle of 90° on $P_{раб}=200$ kg/cm²
(MN 1125-60).



(1) Размеры в мм				(2) Масса в кг
D_y	$D_н$	S	$r=L$	
10	15	2,5	50	0,06
15	22	3	80	0,19
20	28	4	100	0,4
25	35	5	120	0,75
32	42	6	140	1,27
40	55	7,5	180	2,[illegible]
50	70	10	240	6,[illegible]

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

Table 26. Transitions brass on $P_{раб}$=200 kg/cm² (MN 1126-60).



(1) Размеры в мм						(2) Масса в кг
$D_y \times D_y'$	$D_н$	S	$D_в'$	$D_н'$	L	
15×10	22	3	10	15	55	0,11
20×10	28	4				0,16
20×15			16	22		0,19
25×10 25×15 25×20	35	5	10 16 20	15 22 28	65	0,28 0,32 0,35
32×10 32×15 32×20 32×25	42	6	10 16 20 25	15 22 28 35	85	0,5 0,55 0,6 0,65
40×20 40×25 40×32	55	7,5	20 25 30	28 35 42	100	1,11 1,2 1,28
50×25 50×32 50×40	70	10	25 30 40	35 42 55	125	2,35 2,47 2,77

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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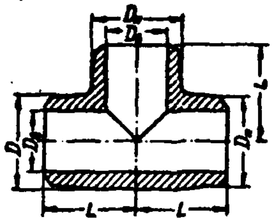
Table 27. T-connections straight/direct brass on $P_{раб}=200$ kg/cm² (MN 1127-60).



(1) Размеры в мм					(2) Масса в кг
D_y	D	$D_в$	$D_н$	L	
10	18	10	16	21	0,07
15	24	16	23	25	0,13
20	30	20	29	28	0,22
25	37	25	36	38	0,5
32	44	30	43	45	0,71
40	58	40	56	55	1,44
50	74	50	71	65	2,8

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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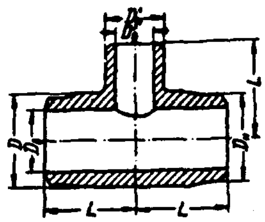
Table 28. T-connections transitional brass on $P_{раб}=200$ kg/cm² (MN 1128-60).



$D_y \times D_y'$	D	$D_в$	$D_в'$	$D_н$	$D_н'$	L	(1) Масса в кг
15×10	24	16	10	23	16	25	0,12
20×15	30	20	16	29	23	28	0,21
25×15	37	25		36		38	0,41
25×20			20		29		0,42
32×10	44	30	10	43	16	45	0,65
32×15			16		23		0,67
32×20			20		29		0,67
32×25			25		36		0,68
40×20	58	40	20	56	29	55	1,28
40×25			25		36		1,3
40×32			30		43		1,31
50×25	74	50	25	71	36	65	2,73
50×32			30		43		2,73
50×40			40		56		2,71

Key: (1). Mass in kg.

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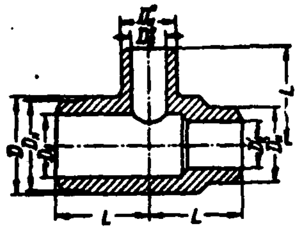
Table 29. T-connections with two transitions brass on $P_{раб}=200$ kg/cm²

(MN 1129-60).



<table>
<tr><th colspan="9">(1) Размеры в мм</th><th rowspan="2">(2) Масса в кг</th></tr>
<tr><th>$D_y\times D_y''\times D_y'$</th><th>$D$</th><th>$D_в$</th><th>$D_в''$</th><th>$D_в'$</th><th>$D_н'$</th><th>$D_н$</th><th>$D_н''$</th><th>$L$</th></tr>
<tr><td>15×10×10</td><td>24</td><td>16</td><td rowspan="2">10</td><td>10</td><td>16</td><td>23</td><td rowspan="2">16</td><td>25</td><td>0,12</td></tr>
<tr><td>20×10×15</td><td rowspan="2">30</td><td rowspan="2">20</td><td rowspan="2">16</td><td rowspan="2">23</td><td rowspan="2">29</td><td rowspan="2">28</td><td>0,21</td></tr>
<tr><td>20×15×15</td><td rowspan="2">16</td><td rowspan="2">23</td><td>0,5</td></tr>
<tr><td>25×15×20</td><td rowspan="2">37</td><td rowspan="2">25</td><td rowspan="3">20</td><td rowspan="3">29</td><td rowspan="2">36</td><td rowspan="2">38</td><td>0,43</td></tr>
<tr><td>25×20×20</td><td rowspan="3">20</td><td rowspan="3">29</td><td>0,81</td></tr>
<tr><td>32×20×20</td><td rowspan="3">44</td><td rowspan="3">30</td><td rowspan="3">43</td><td rowspan="3">45</td><td>0,72</td></tr>
<tr><td>32×20×25</td><td rowspan="3">25</td><td rowspan="3">36</td><td>0,81</td></tr>
<tr><td>32×25×25</td><td rowspan="3">25</td><td rowspan="3">36</td><td>0,74</td></tr>
<tr><td>40×25×25</td><td rowspan="3">58</td><td rowspan="3">40</td><td rowspan="3">56</td><td rowspan="3">55</td><td>1,49</td></tr>
<tr><td>40×25×32</td><td rowspan="3">30</td><td rowspan="3">43</td><td>1,51</td></tr>
<tr><td>40×32×32</td><td rowspan="3">30</td><td rowspan="3">43</td><td>1,5</td></tr>
<tr><td>50×32×32</td><td rowspan="3">74</td><td rowspan="3">50</td><td rowspan="3">71</td><td rowspan="3">65</td><td>3,11</td></tr>
<tr><td>50×32×40</td><td rowspan="2">40</td><td rowspan="2">56</td><td>3,01</td></tr>
<tr><td>50×40×40</td><td>40</td><td>56</td><td>3</td></tr>
</table>

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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§5. Ducts bronze (GOST 1208-54).

Ducts bronze pressed prepare from bronze of brands/marks BrAZhMts10-3-1.5 and BrAZhN10-4-4 according to GOST of 493-54 following sizes/dimensions in mm:

the outside diameter: [illegible]; 65; [illegible]; [illegible]; 70; 75; [illegible]; [illegible]; [illegible]; [illegible]; 100; 105; 110; 115; 120; 125; 130; 135; 140; [illegible]; [illegible]; [illegible]; [illegible]; [illegible]; [illegible];

the wall thickness: 5; 7.5; 10; 12.5; 15; 17.5; [illegible]; [illegible]; [illegible]; [illegible]; [illegible]; 37.5; 40; 42.5; 50.

Sizes/dimensions and mass of the frequently used bronze ducts are given in Tables 30.

The chemical composition and the mechanical properties of the metal of bronze ducts are given in Table 16, chapter I.

Table 30. Ducts bronze pressed (GOST 1208-54).

(1) Наружный диаметр $D_н$, мм	S, мм								
	5	7,5	10	15	20	25	30	40	50
	(2) Масса 1 пог. м труб в кг								
50	5,3	7,4	—	—	—	—	—	—	—
60	6,48	9,27	11,77	—	—	—	—	—	—
70	—	11,04	14,13	19,43	—	—	—	—	—
80	—	12,8	16,48	22,96	28,26	—	—	—	—
90	—	14,58	18,85	26,51	33	38,29	—	—	—
100	—	—	21,21	30,04	37,7	44,18	49,48	—	—
120	—	—	—	37,11	47,12	55,96	63,45	—	—
140	—	—	—	44,18	56,55	67,61	77,75	—	—
160	—	—	—	51,25	65,97	79,52	91,75	—	—
190	—	—	—	—	80,11	97,2	113,1	141,37	—
220	—	—	—	—	—	—	132,2	169,5	197,2

Note. The mass of 1 lin. m of ducts is determined for bronze of brand AZhMts10-3-1.5 with a density of 7.5. During the computation of the mass of ducts for bronze of brand BrAZhN10-4-4 to accept K=1.027.

Key: (1). Outside diameter. (2). Mass of 1 lin. m of ducts in kg.

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§6. Ducts lead (GOST 167-69).

Ducts lead pressed prepare from lead of brands S0, S1, S2 and S3 (GOST 3778-65*) the following sizes/dimensions in mm:

the outside diameter: 15; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 47; 48; 49; 50; 51; 52; 53; 54; 55; 56; 57; 58; 59; 60; 61; 62; 63; 64; 65; 66; 67; 68; 69; 70; 71; 72; 73; 74; 75; 76; 78; 79; 80; 83; 84; 87; 88; 89; 92; 93; 94; 98; 104; 108; 114; 118; 124; 128; 141; 145; 166; 170;

the wall thickness: 2; 2.5; 3; 3.5; 4; 5; 6; 7; 8; 9; 10.

Sizes/dimensions and mass of the frequently used ducts are given in Table 31.

The chemical composition of lead ducts is given in Table 17, chapter I.

Table 31. Ducts lead pressed (GOST 167-69).

$D_в$, мм	S, мм								
	2,5	3	4	5	6	7	8	9	10
	(1) Масса 1 пог. м в кг								
10	—	—	2	2,7	—	—	—	—	—
19	1,9	2,4	3,3	4,3	5,3	—	—	—	—
25	2,4	3	4,3	5,5	6,7	8,2	9,5	—	—
30	—	3,6	4,9	6,2	7,7	9,2	11	—	—
35	—	4,1	5,6	7,1	8,8	10,5	12,3	—	—
40	—	—	6,3	8	9,9	11,7	13,7	—	—
50	—	—	—	—	12	14,2	16,6	18,9	—
60	—	—	—	11,6	14,1	16,7	19,4	22,1	—
70	—	—	—	13,4	—	19	—	25,3	—
80	—	—	—	—	16,3	21,8	—	28,6	—
90	—	—	—	—	—	24,9	—	31,8	—
100	—	—	—	—	—	26,8	—	35,1	—
125	—	—	—	—	—	—	36,8	—	46
150	—	—	—	—	—	—	46,5	—	57,1

Note. The length of straight/direct ducts in bore more than 60 mm and in diameter 50 and 55 mm with the thickness of wall 4 and 5 mm must be not less than 1.8 m.

Ducts from $D_в$ to 60 mm inclusively supply in the bays, sheathed by panels.

Key: (1). Mass of 1 lin. m in kg.

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Chapter VIII.

DUCTS AND PARTS OF CONDUITS/MANIFOLDS FROM PLASTICS AND STEEL WITH INTERNAL CORROSION-RESISTANT COATINGS.

§1. Plastic ducts and parts of conduits/manifolds.

1. General information.

Ducts and parts of conduits/manifolds frcm plastics are used for the transporting of different corrosion, which destroy steel products, and also as the substitutes of the expensive ducts from high-alloy steel and nonferrous metals. The utilization of plastic ducts of instead of steel ones makes it possible to lower the consumption of the alloy and high-alloy steel, to raise the service life of conduits/manifolds (because of their high corrosion resistance) and to reduce expenditures for heat insulaticn as a result of their small heat conductivity.

The basic physicochemical properties of the plastics from which are prepared the ducts, examined/considered in present chapter, are

given in Table 1.

The limits of the use/application of the plastic ducts (operating pressure and temperature of product) are shown in Table 2.

Table 1. Basic physicochemical properties of plastics.

(1) Наименование материала	(2) Плотность в $г/см^3$	(3) Пределы прочности в $кгс/см^2$		
		(4) при растяжении	(5) при изгибе	(6) при сжатии
(7) Винипласт	1,38—1,46	400—600	900—1200	800—1000
(8) Полиэтилен:				
(9) низкой плотности	0,92—0,93	120—160	120—170	125
(10) высокой плотности	0,95	220—350	200—380	—
(11) Полипропилен	0,9	300—360	500—700	600—700
(12) Фторопласт-4	2,1—2,4	140—315	110—140	—
(13) Фаолит	1,4—1,7	200	400	700—800

Key: (1). Designation of material. (2). Density in g/cm^3. (3). Ultimate strength in kg/cm^2. (4). with stretching. (5). with bend. (6). during compression. (7). Polyvinyl chloride plastic. (8). Polyethylene. (9). low density. (10). high density. (11). Polypropylene. (12). Teflon. (13). Faolite.

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Table 2. Characteristic of ducts and parts of conduits/manifolds from plastics.

(4) Наименование	(1) Нормали, технические условия		(2) Пределы применения		(3) Размеры в мм		(8) № таблиц
	(5) трубы	(6) детали трубопроводов	(7) P_p, кгс/см²	Т, °C	D_y	L	
			(9) не более				
	(10) Нормали Владимирского химического завода						
(11) Винипластовые	ВХЗ-06-124	ВХЗ-06-125-134	6	(14) От 0 (15) до +40	15—150	1000—3 000	3—6
(12) Полиэтиленовые:							
(13) а) из полиэтилена высокой плотности (ПВП)	а) МРТУ 6-05-917-67	а) МН 3005-61 — МН 3018-61	10	(14) От −60 (15) до +50	15—300	6000—12 000	7—10
(16) б) из полиэтилена низкой плотности (ПНП)	б) МРТУ 6-05-918-67	б) МН 3005-61 — МН 3018-61	10	(14) От −60 (15) до +60	15—150	6000—12 000	7—10
(17) Фаолитовые	МРТУ 6-05-1170-69 (18) и нормаль № 24-39		4,7	(14) От −30 (15) до +120	32—350	1000—2 000	11—18
(19) Полипропиленовые	МРТУ 6-05-1045-67	(20) ТУ заводов-изготовителей	10	(14) От −60 (15) до +150	15—100	6000—12 000	19
(21) Фторопластовые	МРТУ 6-05-987-66	(22) То же	4	(14) От −196 (15) до +250	50—400	1000—3 200	20

Key: (1). Standards, technical specifications. (2). Limits of use/application. (3). Sizes/dimensions in mm. (4). Designation. (5). duct. (6). part of conduits/manifolds. (7). kg/cm². (8). Table. (9). it is not more. (10). Standards of Vladimir chemical plant. (11). Polyvinyl chloride. (12). Polyethylene. (13). from polyethylene of high density. (14). From. (15). to. (16). from low-density polyethylene. (17). Faolite. (18). and standard. (19). Polypropylene. (20). manufacturing plants. (21). Teflon. (22). The same

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Polyvinyl chloride plastic (solid polyvinyl chloride) obtains from pure/clean polyvinylchloride resin with stabilizer (amines, oxides of metals, etc.); it has high mechanical strength, it yields to machining, is welded and it is cemented. From polyvinyl chloride plastic are prepared the ducts, the parts of conduits/manifolds, the valves/gates and the taps/cranes. The mechanical properties of polyvinyl chloride plastic do not change at temperature from 10 to 50°c. Main disadvantage in polyvinyl chloride plastic is its brittleness at temperature lower than zero, and also tendency toward strain with the long effective loads.

Polyethylene of low and high density obtain by the polymerization of ethylene respectively with high - about 1500 kg/cm² and low - 2-6 kg/cm² pressure. From polyethylene are prepared the ducts, shaped parts, fittings, sheets, films, etc. Polyethylene yields well to machining, easily is pressed and it is cast under pressure.

The polypropylene, which is the polymer of propylene, has the major advantage before polyvinyl chloride plastic and polyethylene:

its mechanical properties at elevated temperatures (to +100°C) change very insignificantly.

Teflon - most chemically and thermally stable material of all known plastics; on chemical stability it exceeds gold, platinum, special stainless steel, china and other materials, used in agressive media, it is dissolved not in one solvent.

Faolite - heat-reactive material, which consists of resol phenol-formaldehyde resin and filler (asbestos, graphite or quartz sand). Depending on filler faolite they mark by the letters: A - asbestos; P - sand; T - graphite.

Faolite is cemented well, and it also yields to machining. Main disadvantages in the faolite are brittleness, low resistance to the bending and vibration loads, and also inadmissibility of a large temperature differential between the internal and external surface of articles.

The fundamental characteristics of ducts and parts of conduits/manifolds of the enumerated above forms of plastics are given in Table 2.

On sizes/dimensions and tolerances the ducts and the part of

conduits/manifolds from plastics must satisfy the requirements of the corresponding standards of machine-building, technical specifications, and also factory standards. The mass, indicated in tables, is given as reference, and deviation from it sorting index is not. Ducts and parts of conduits/manifolds from plastics must be stored in the dry closed rooms on racks, in banks (duct) or in boxes (part), far from heaters and in the places, shielded from the straight/direct effect of solar rays/beams.

2. Ducts and part of conduits/manifolds from polyvinyl chloride plastic.

Polyvinyl chloride ducts and parts of conduits/manifolds produce on $P_y = 2.5$ and 6 kg/cm² on the standards of Vladimir chemical plant (Table 3-6). Ducts prepare by the extrusion through special matrices/dies on hydraulic presses (pressure forging), and the parts of conduits/manifolds - from polyvinyl chloride ducts by flexure and by weld.

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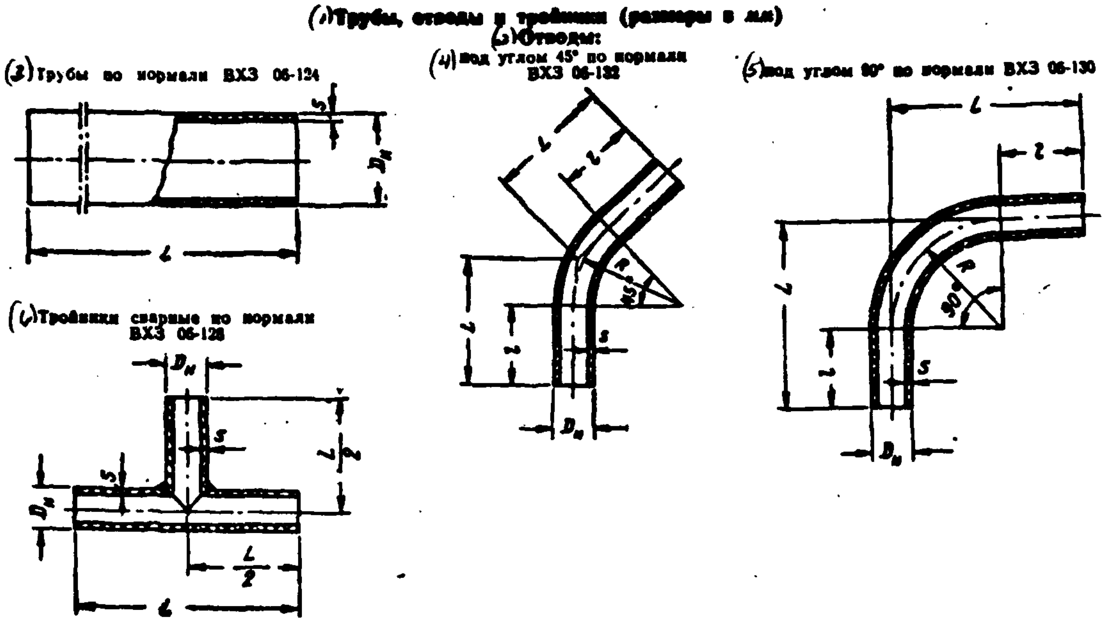
Table 3. Ducts in the part of conduits/manifolds from polyvinyl chloride plastic on the standards of Vladimir chemical plant.



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(8) P_y, кгс/см²	D_y	$D_н$	S	L: (9) труб	L: (10) отводов под углом 45°	L: отводов под углом 90°	L: (11) тройников	R	l	(7) Масса в кг: (12) 1 пог. м труб	Масса в кг: отводов под углом 45°	Масса в кг: отводов под углом 90°	Масса в кг: (11) тройников
6	15	20	2,5	(13) От 1000 (14) до 3000	75	110	150	60	50	0,19	0,03	0,04	0,04
	20	25	3		95	150	180	90	60	0,29	0,05	0,08	0,1
	25	32	4		115	180	200	110	70	0,49	0,11	0,15	0,15
	32	40	5		145	230	230	130	90	0,77	0,21	0,29	0,27

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6	40	51	6		165	260	260	160	100	1,19	0,39	0,53	0,46
	50	63	7		205	320	300	200	120	1,74	0,69	0,96	0,78
2,5	65	83	6		250	410	360	270	140	2,2	1,08	1,55	1,2
	80	96	6,5	(13) От 1000 (14) до 3000	275	450	400	300	150	2,53	1,36	1,95	1,52
	100	114	7		325	530	480	350	180	3,3	2,09	3	2,4
	125	140	8		390	640	580	430	210	4,64	3,13	5,08	3,71
	150	166	8		460	770	680	530	240	5,6	5,02	7,34	5,25

Key: (1). Ducts, offtakes and T-connections (sizes/dimensions in mm). (2). Offtakes. (3). Ducts along the normal. (4). at angle of 45° along the normal. (5). at angle of 90° along the normal. (6). T-connections (welded along the normal). (7). Mass in kg. (8). kg/cm². (9). ducts. (10). offtakes at angle. (11). it is branch. (12). 1 running meter of pipe. (13). From. (14). to.

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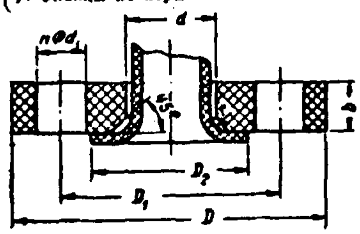
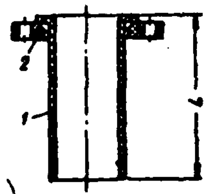
Table 4. Flanges polyvinyl chloride free on the flanged duct and branch connections terminal polyvinyl chloride with slip-on flanges on flanging (sizes/dimensions in mm).

(1) Фланцы по нормали ВХЗ 06-125



(2) Патрубки по нормали ВХЗ 06-126



(3) 1 — патрубок; 2 — фланец винипластовый по ВХЗ 06-125

(4) P_y, кгс/см²	D_y	D	D_1	D_2	d	b	d_1	r	L	(5) Количество отверстий	(6) Масса в кг: (7) фланца	(8) патрубка с фланцем
6	15	80	55	40	23	12	12	3	75	4	0,07	0,08
	20	90	65	50	28	15			90		0,11	0,14
	25	100	75	60	35			4	100		0,13	0,2
	32	120	90	70	44		14		115		0,18	0,28
	40	130	100	80	55	17			130		0,24	0,39
	50	140	110	90	67				150		0,26	0,52
2,5	65	160	130	110	88	20			180		0,37	0,77
	80	190	150	128	100		18	5	200		0,54	1,04
	100	210	170	148	120				240		0,58	1,38
	125	240	200	178	147				290	8	0,6	2,01
	150	270	225	202	174	22			340		0,97	2,98

Notes: 1. Material of flange - polyvinyl chloride plastic of laminated (GOST 9639-71).

2. Branch connection - from duct on VKhZ 06-124; $D_н$ and S - see Table 3.

Key: (1). Flanges along the normal. (2). Branch connections along the normal. (3). 1 - branch connection; 2 - flange polyvinyl chlcride on VKhZ 06-125. (4). kg/cm². (5). Quantity of holes. (6). Mass in kg. (7). flange. (8). flanged nozzle.

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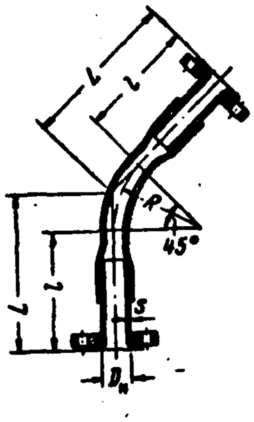
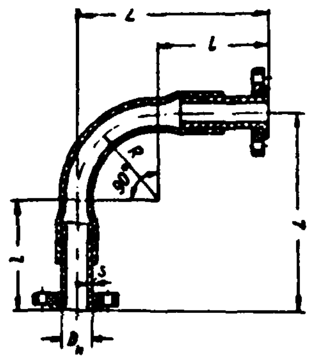
Table 5. Offtakes, T-connections and cross pieces from polyvinyl chloride plastic with slip-on flanges on flanging (sizes/dimensions in mm).

(1) Отводы:

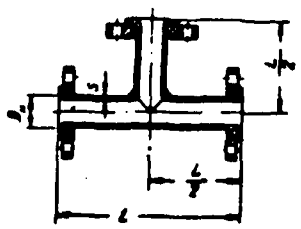
(2) под углом 45° по нормали ВХЗ 06-131



(3) под углом 90° по нормали ВХЗ 06-129

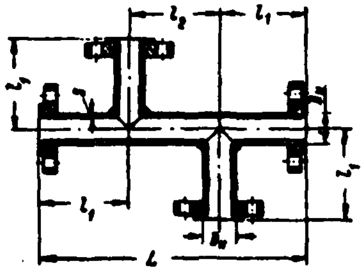


(4) Тройники по нормали ВХЗ 06-127



continuation Table 5.

(5) Крестовины по нормали ВХЗ 66-139



P_y, кгс/см² (6)	D_y	L (7) отводов под углом 45°	L (7) отводов под углом 90°	L (8) тройники	L (9) крестовины	l	l_1	l_2	(10) Масса с фланцами в кг (7) отводов под углом 45°	Масса с фланцами в кг, отводов под углом 90°	Масса с фланцами в кг (8) тройников	Масса с фланцами в кг (9) крестовин
5	15	120	155	150	225	95	75	75	0,19	0,22	0,26	0,33
	20	145	200	180	270	110	90	90	0,34	0,36	0,44	0,50
	25	165	230	200	300	120	100	100	0,51	0,5	0,57	0,65
	32	205	280	210	315	130	115	115	0,71	0,9	0,85	1,2
	40	225	320	260	380	160	130	120	1,17	1,4	1,24	1,7
	50	275	390	300	430	190	150	130	1,73	2,2	1,64	2,1
2,5	65	340	500	360	510	230	180	150	2,62	3,4	2,41	3,41
	80	375	550	400	565	250	200	165	3,44	4,4	3,28	4,58
	100	415	650	480	660	300	240	180	4,85	6,2	4,33	5,88
	125	535	765	580	790	355	290	210	7,15	9,1	5,69	9,01
	150	630	940	640	940	410	310	260	10,94	13,26	8,38	13,3

the notes: 1. Sizes/dimensions D_H, S and R - see Table 3.

2. Flanges - see Table 4.

Key: (1). Offtakes. (2). at angle of 45° along the normal. (3). at angle of 90° along the normal. (4). T-connections along the normal. (5). Cross pieces along the normal. (6). kg/cm². (7). offtakes at angle. (8). T-connection. (9). cross piece. (10). Mass with flanges in kg.

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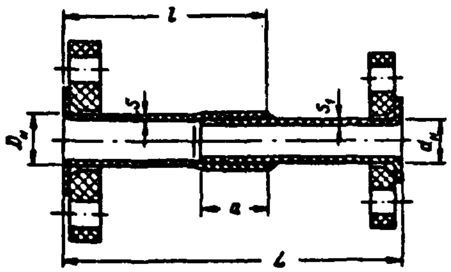
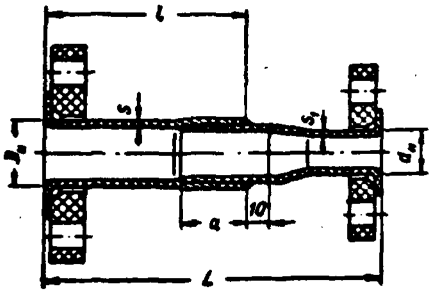
Table 6. Transitions polyvinyl chloride with slip-on flanges on flanging along the normal VKhZ 06-134 (sizes/dimensions in mm).

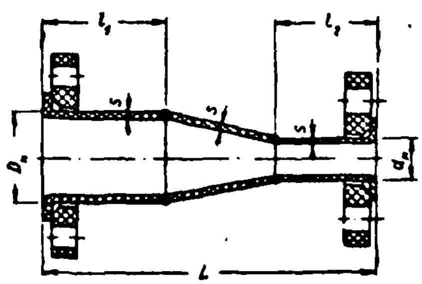
(1) Исполнение 1



(1) Исполнение 2



(1) Исполнение 3



(2) P_y, кгс/см²	$D_y \times d_y$	L	l	l_1	l_2	a	(3) Масса в кг	(4) Исполнение
6	20×15	150	80	—	—	30	0,28	1
	25×15						0,28	2
	25×20						0,26	1

continuation table 6.

6	32×20	180	105	—	—	35	0,40	2
	32×25						0,46	1
	40×25		—	70	50	—	0,56	3
	40×32	200	120	—	—	40	0,66	1
	50×32		—	70	50	—	0,71	3
	50×40		125	—	—	45	0,86	1
2,5	65×40	230	—	80	65	—	0,92	3
	65×50		140	—	—	50	1,18	2
	80×50	240	—	85	70	—	1,76	3
	80×65		140	—	—	50	1,50	2
	100×65	250	—	90	75	—	1,60	3
	100×80		150	—	—	60	2,60	2

Notes: 1. Sizes/dimensions $D_н$ and S - see Table 3. 2. Sizes/dimensions $d_н$ and S_1 correspond to sizes/dimensions $D_н$ and S Table 3. 3. Flanges - see Table 4.

Key: (1). Performance. (2). kg/cm². (3). Mass in kg. (4). Performance.

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3. Ducts and part of conduits/manifolds from polyethylene.

Of all plastic ducts in recent years the widest acceptance for manufacturing the technological conduits/manifolds received polyethylene ducts. They are considerable (to 40o/o) more easily polyvinyl chloride, they are cold-resistant (to -65°C) and elastic, thanks to which it is possible to prepare them large length, to coil up (at temperature not higher than 30°C) and in this form to transport. The combination of elasticity and cold-resistance of polyethylene ducts provides the reduction of original form after the removal of the loads, caused, for example, by the freezing of water in the polyethylene ducts; after the thawing of ice the deformed duct again assumes previous form and sizes/dimensions.

Polyethylene ducts produce four types:

a) light L, calculated for the maximum operating pressure [1] 2.5 kg/cm²;

b) medium-light SL - to pressure 4 kg/cm²;

c) average/mean S - to pressure 6 kg/cm^2;

d) heavy T - to pressure 10 kg/cm^2.

FOOTNOTE [1]. Maximum operating pressure shown for the transporting of water with 20°C. ENDFOOTNOTE.

Table 7. Ducts from low-density polyethylene (MRTU 6-05-918-67) (sizes/dimensions in mm, mass of 1 running m in kg.).

$D_н$	(1) Тип трубы							
	Л		СЛ		С		Т	
	S	(2) Масса	S	(2) Масса	S	(2) Масса	S	(2) Масса
20	—	—	—	—	2,2	0,13	3,4	0,18
25	—	—	2	0,15	2,7	0,2	4,2	0,28
32	—	—	2,5	0,23	3,5	0,32	5,4	0,46
40	2	0,28	3	0,36	4,3	0,49	6,7	0,71
50	2,4	0,39	3,7	0,55	5,4	0,76	8,4	1,1
63	3	0,59	4,7	0,87	6,8	1,21	10,5	1,73
75	3,6	0,83	5,6	1,23	8,1	1,71	12,5	2,43
90	4,3	1,18	6,7	1,76	9,7	2,43	15	3,49
110	5,3	1,76	8,2	2,62	11,8	3,6	18,4	5,21
140	6,7	2,82	10,4	4,25	—	—	—	—
160	7,7	3,7	11,9	5,53	—	—	—	—

Notes: 1. Material of duct - low-density polyethylene of brand 17601-006 according to GOST 16337-70.

2. Ducts in diameter from 20 mm and more supply by linear segments in long 6, 8, 10 and 12 m with by manufacturing tolerances from lengths indicated +-50 mm. Is allowed/assumed the delivery of ducts in long 5.5 and 11.5 m.

Key: (1). Type of duct. (2). Mass.

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The parts of conduits/manifolds from polyethylene are prepared in essence from polyethylene ducts by flexure and by weld (see Chapter XIV).

The structural sizes/dimensions of the fabricated members of conduits/manifolds from polyethylene should be accepted as for parts, from polyvinyl chloride plastic.

Riga, Vilnius and Tambovo plants produce according to limiting nomenclature the castings of conduits/manifolds from high-density polyethylene on the standards of machine-building; enumeration and sizes/dimensions of these parts are given in Table 9.

Table 8. Ducts from high-density polyethylene (MRTU 6-05-917-67) (sizes/dimensions in mm, mass of 1 running m in kg.).

$D_н$	(1) Тип трубы							
	Л		СЛ		С		Т	
	S	(2) Масса	S	(2) Масса	S	(2) Масса	S	(2) Масса
20	—	—	—	—	—	—	2	0,12
25	—	—	—	—	—	—	2,3	0,19
32	—	—	—	—	2	0,2	2,9	0,29
40	—	—	—	—	2,3	0,29	3,7	0,44
50	—	—	2	0,32	2,9	0,45	4,6	0,68
63	—	—	2,5	0,51	3,6	0,71	5,8	1,08
75	2	0,40	2,9	0,7	4,3	1,06	6,9	1,53
90	2,2	0,63	3,5	1,02	5,1	1,54	8,2	2,18
110	2,7	0,97	4,3	1,51	6,3	2,14	10	3,24
140	3,5	1,58	5,4	2,41	8	3,44	12,8	5,26
160	4	2,06	6,2	3,17	9,1	4,47	14,6	6,86
225	5,5	3,94	8,7	6,2	12,8	8,8	—	—
280	6,9	6,15	10,8	9,55	—	—	—	—
315	7,7	7,75	12,3	12,1	—	—	—	—

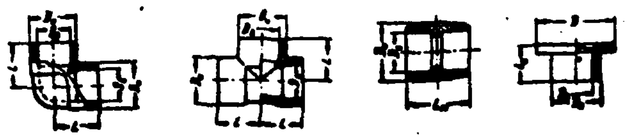
Notes: 1. Material of ducts - high-density polyethylene of brand 20306-005 according to GOST 16338-70.

2. Ducts supply by linear segments in long 6, 8 and 12 m with by manufacturing tolerances from lengths indicated +-50 mm. Is allowed/assumed the delivery of ducts with a length of 5.5 about 11.5 m.

Key: (1). Type of duct. (2). Mass.

Table 9. Parts of conduits/manifolds poured from polyethylene.

(1) Угольники (МН 3007-61) (2) Тройники (МН 3006-61) (3) Муфты соединительные (МН 3009-61) (4) Втулки под фланцы (МН 3016-61)



D_y	(5) Размеры в мм						(6) Масса в кг			
	$D_н$	$D_в$	L	$L_м$	D	$L_в$	(7) угольника	(8) тройника	(9) муфты	(10) втулки
$P_y = 10$ (11) кгс/см²										
15	27	20	24	—	40	16	0,013	—	—	0,007
20	34	25	28	—	—	—	—	0,028	—	—
25	43	32	34	35	60	21	0,041	0,054	0,022	0,02
50	84	63	56	48	102	27	0,19	0,22	0,105	0,095
100	134	110	89	70	—	—	—	—	0,31	—
$P_y = 6$ (11) кгс/см²										
160	160	160	—	85	—	—	—	—	0,465	—

Key: (1). Angle plates. (2). T-connections. (3). Clutches (uniting. (4). Bushings under flanges. (5). Sizes/dimensions in mm. (6). Mass in kg. (7). angle plate. (8). T-connection. (9). clutch. (10). bushing. (11). kg/cm².

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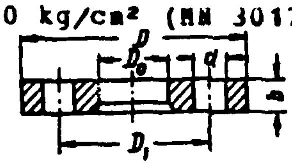
Table 10. Flanges steel for conduits/manifolds from polyethylene on P_y=2,5; 6 and 10 kg/cm² (MH 3017-61).



(3) P_y, кгс/см²	(1) Размеры в мм					(2) Отверстия под болты		(5) Масса в кг
	D_y	D_0	D	D_1	b	d, мм	(4) количество	
6	15	28	80	55	10	12		0,31
10			95	65	12	14		0,55
6	20	35	90		10	12		0,38
10			105	75	14	14	4	0,77
6	25	44	100		12	12		0,56
10			115	85	14	14		0,9
6	32	51	120	90	12	14		0,8[illegible]

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Table 10 continued.

10	[illegible]	[illegible]	135	100	16	16		1,35
6	40	60	130		12	14		0,9
10		60	145	110	16	16		1,68
6	50	76	140		12	14		1,04
10		86	160	125	16	16		1,80
6	65	94		130	14	14	4	1,36
10			180	145	20	18		2,7
6	80	112	185	150	14			1,76
10			195	160	22			3,3
6	100	134	205	170	14			2,1
10			215	180	24			3,73
2,5; 6	125	160	235	200	14		8	2,3
10		168	245	210	26			4,7
2,5; 6	150	183	260	225	16			3,12
10		190	280	240	26	23		5,9

Key: (1). Sizes/dimensions in mm. (2). Bolt holes (3). kg/cm². (4). quantity. (5). Mass in kg.

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4. Ducts and part of conduits/manifolds from faolite.

They produce in accordance with MRTU 6-05-1170-69 on standards No 24-39 of faolite brands A, P and T. They are intended for the transport of acids and other liquid and gaseous agressive products.

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Made of all plastics used only faolite articles are chemically stable to benzene. Faolite conduits/manifolds can work in large temperature range.

Faolite ducts from D_y to 150 mm prepare on extruders, and large-diameter ducts - from damp/crude sheets by molding in wooden or metallic detachable templates/patterns. The parts of conduits/manifolds are prepared by pressure forging in metal molds or by cementing by the resin luting composition.

For an increase in the service life the internal and external surfaces of articles made of faolite they cover/coat with Bakelite varnish.

Faolite articles are characterized by significant brittleness; therefore during transport and their assembly one should be cushioned against shocks, and also abrupt changes in the temperature.

In the case of damage - crack formation, after splitting off or holes - faolite articles are repaired with the aid of the resin

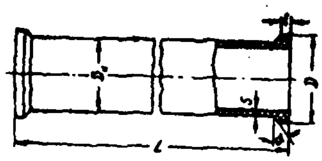
luting composition.

The allowable operating pressures for faolite conduits/manifolds depend on diameter and are equal to:

(1) Для трубопроводов	D_y=32÷50 мм	4,7	(2) кгс/см²
(3) то же,	D_y=80÷100 »	4	»
» »	D_y=150÷200 »	2,4	»
» »	D_y=250÷300 »	1,6	»
» »	D_y=350 »	1,3	»

Key: (1). For conduits/manifolds. (2). kg/cm². (3). the same.

Table 11. Faolite ducts with collars.



(1) Размеры в мм						α	(2) Масса в кг
D_y	$D_н$	D	S	L	l		
32	50	67	8,5	2000	12	45°	4,2
50	76	98	11				8,3
80	102	130	12		15		12,8
100	125	180	12,5	2000	15	45°	16,8
150	175	210		1000	20	60°	12,5
200	225	265			30		16,8
250	275	330			40		21,5
300	330	390	15		45		30,5
350	380	440					40,5

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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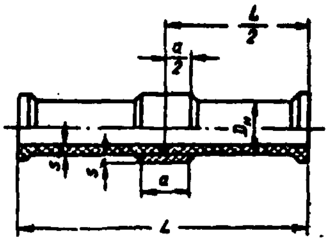
Table 12. Faolite ducts with binding band.



(1) Размеры в мм					(2) Масса в кг
D_y	$D_н$	S	L	a	
150	175	12,5	2000	120	26,5
200	225				35,4
250	275			150	45,8
300	330	15			64,5
350	380				85,5

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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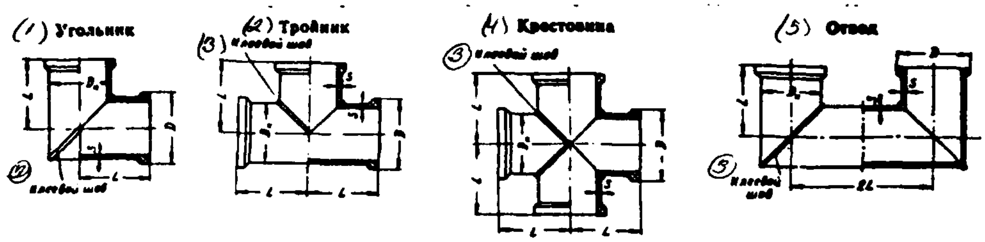
Table 13. Faolite square elbows, T-connections, cross pieces and set-off bends.



(6) Размеры в мм					(7) Масса в кг			
D_y	$D_н$	D	S	L	угольника	тройника	крестовины	отвода
32 50 80	50 76 102	67 98 126	8,5 11 12	110 130 150	0,6 1,2 2,2	0,8 1,7 2,9	1 2,2 3,7	1 2,8 4,2
100 150 200 250	125 175 225 275	150 210 265 330	12,5	160 230 300 360	3 6,3 10 17,3	4 8,3 16,3 25,5	4,8 10,5 18,5 31,3	6,5 11,9 20,5 31,2
300 350	330 380	390 440	15 15	365 410	25,8 33,5	36,8 51,5	48,8 62,5	46,6 48,5

Note. The sizes/dimensions of collars see in Table 11.

Key: (1). Angle plate. (2). T-connection. (3). Adhesive weld. (4). Cross piece. (5). Offtake. (6). Sizes/dimensions in mm. (7). Mass in kg.

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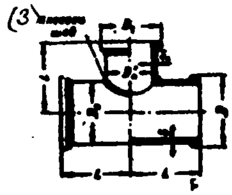
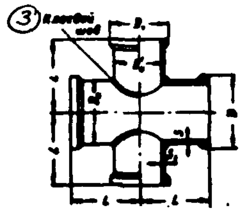
Table 14. Faolite T-connections and cross pieces are transitional.

(1) Крестовины



(2) Тройники



$D_y \times D'_y$	$D_н$	D	$D'_н$	D_1	S	S_1	L	(5) Масса в кг: (2) тройника	(1) крестовины
(4) Размеры в мм									
50×32	76	96	50	76	11	8,5	150	1,6	1,74
50×50	102	126	76	96	12	11	150	2,5	3,1
100×50	125	150	76	96	12,5	11	160	3,5	3,9
100×80	125	150	102	125	12,5	13	160	3,7	4,4
150×80	175	210	102	125	12,5	13	230	7,2	8,2
150×100	175	210	125	150	12,5	12,5	230	7,5	8,9
200×100	225	265	125	150	12,5	12,5	300	12,5	14
200×150	225	265	175	210	12,5	12,5	300	14	16
250×100	275	330	125	150	12,5	12,5	300	18,5	20
250×200	275	330	225	265	12,5	12,5	360	22	25,5
300×100	330	390	125	150	15	12,5	366	26,5	28,3
300×150	330	390	175	210	15	12,5	366	27,3	29,7
300×250	330	390	275	330	15	12,5	366	32	39,7
350×100	380	440	125	150	15	12,5	366	33,8	35,5
350×150	380	440	175	210	15	12,5	366	34,8	37,8

Note. The sizes/dimensions of collars - see Table 11.

Key: (1). Cross connections. (2). T-connections. (3). Adhesive weld. (4). Sizes/dimensions in mm. (5). Mass in kg.

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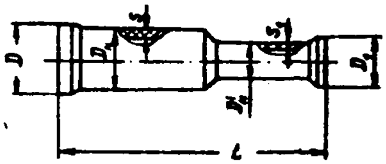
Table 15. Faolite transitions are single-stage.

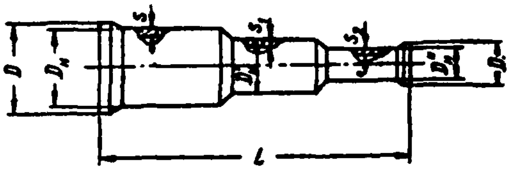


(1) Размеры в мм								(2) Масса в кг
$D_y \times D'_y$	$D_н$	D	S	$D'_н$	D_1	S_1	L	
50×32	76	98	11	60	67	8,5	260	1,2
80×50	102	126	12	76	98	11		1,8
100×80	125	150	12,5	102	126	12		2,5
150×100	175	210		125	150	12,5		4,1
200×150	225	265		175	210			6,6
250×200	275	330		225	265		320	8,5
300×250	330	390	15	275	330		310	12,6
350×300	380	440		330	390	15	600	27,4

Note. The sizes/dimensions of collars - see Table 11.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

Table 16. Faolite transitions are two-stage.



(1) Размеры в мм										(2) Масса в кг
$D_y \times D'_y$	$D_н$	D	S	$D'_н$	S_1	$D''_н$	D_1	S_2	L	
100×50	125	150	12,5	102	12	76	98	11	390	2,9
150×80	175	210	12,5	126	12,5	102	126	12	390	4,7
200×100	225	265		175		126	150	12,5		7,6
250×150	275	320		225		175	210		440	9,5
300×200	320	380	16	275		225	265		460	13,5

Note. The sizes/dimensions of collars - see Table 11.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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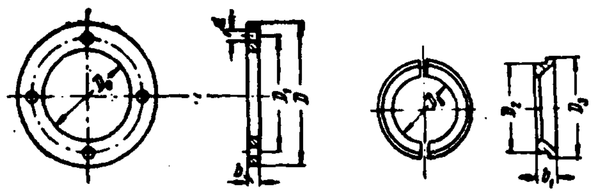
Table 17. Flanges and split collars are steel for conduits/manifolds from faolite.



(1) Труба		(2) Фланцы					(3) Кольца				(4) Болты		
(5) Размеры в мм													(6)
D_y	$D_н$	D	D_1	D_0	b	d	$D_в$	D_2	D_3	b_1	d	l	количество
32	50	130	100	70	10	14	52	68	76	15	12	70	4
50	73	160	130	102	10	11	78	100	110	15	12	70	4
80	102	190	150	130	12	18	101	128	140	15	16	85	4
100	125	220	180	154	12	18	127	152	165	15	16	85	4
150	175	280	250	215	14	18	178	212	230	20	16	120	4
200	225	335	305	270	16	18	228	267	285	20	16	140	4

Note. The sizes/dimensions of flanges for conduits/manifolds from faolite are not standardized. Manufacturing plants are produced from according to their technical specifications.

Key: (1). Duct. (2). Flanges. (3). Rings. (4). Bolts. (5). Sizes/dimensions in mm. (6). quantity.

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5. Ducts from polypropylene.

Ducts of polypropylene produce on MRTU 6-05-1045-67 three types:

a) type C, calculated for maximum operating pressure 6 kg/cm²;

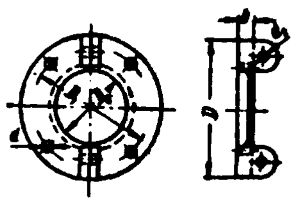
b) type T - to pressure 10 kg/cm²;

c) type OT - to pressure 10 kg/cm².

Ducts are prepared by the method of uninterrupted auger extrusion from heat- and light-stabilized, granulated polypropylene.

Table 18. Flanges split pig iron for conduits/manifolds from faolite[1].

FOOTNOTE [1]. See note to Table 17. ENDFOOTNOTE.



(1) Труба	(2) Фланцы							(3) Длинные болты			(4) Короткие болты		
(5) Размеры в мм													
D_y	$D_н$	D	D_1	D_0	b	d	d_1	d	l	(6) количество, шт.	d	l	(6) количество, шт.
32	50	130	100	51	14	13	11	12	65	4	10	34	4
50	76	160	130	77	14	13	13	12	70	4	12	36	4
80	102	190	150	108	16	17	15	16	75	4	14	42	4
100	125	220	180	126	16	17	15	16	75	4	14	42	4
150	175	280	250	178	18	17	15	16	100	4	14	42	4
200	225	335	30[illegible]	228	20	17	15	16	120	4	14	42	4

Key: (1). Duct. (2). Flanges. (3). Long bolts. (4). Short bolts. (5). Sizes/dimensions in mm. (6). quantity, pieces.

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6. Ducts from teflon.

Ducts of fluoroplast-4 produce on MRTU 6-05-987-66 to the

operating pressure:

a) for ducts from D_y to 100 mm inclusively - 4 kg/cm²;

b) for ducts from D_y from 200 mm even above - 2 kg/cm².

Ducts prepare by method pressure forgings of the powder of teflon in steel duct- matrix/die with the subsequent heat treatment of the obtained damp/crude duct at temperature of 375°C.

Table 19. Ducts from polypropylene (MRTU 6-05-1045-67) (sizes/dimensions in mm, mass of 1 lin. m in kg.).

D_y	$D_н$	(1) Тип трубы					
		С		Т		ОТ	
		S	(2) масса	S	(2) масса	S	(2) масса
15	20	—	—	—	—	2,5	0,14
25	32	—	—	2,5	0,22	4	0,34
50	63	3	0,54	5	0,87	7,5	1,33
100	110	5,3	1,61	8,5	2,64	—	—

Notes: 1. Ducts supply by linear segments in long 6, 8, 10 and 12 m with by manufacturing tolerance from the length indicated ±50 mm. Is allowed/assumed the delivery of ducts in long 5.5 and 11.5 m with the deviation of ±50 mm.

2. Ducts, intended for household drinking water supply and transport of other food media, must be prepared from formulas of polypropylene, matched with organs/controls of sanitary-epidemiological service.

Key: (1). Type of duct. (2). mass.

Table 20. Ducts from teflon (MRTU 6-05-987-66).

(1) Размеры в мм			(2) Масса в кг
$D_у$	$D_н$	S	
50	58	4	1,75
80	85	5	3
100	112	6	5,5
200	220	10	16,7
300	324	12	28
400	430	16	48

Notes: 1. Material of ducts - powder of teflon of brands V(B) (GOST 10072-62).

2. Length of ducts from 1 to 3.2 m.

3. According to agreement with customer ducts can be supplied with slip-on flanges on flanging.

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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§2. Steel tubes and parts of conduits/manifolds with internal corrosion-resistant nonmetallic coatings.

1. General information.

Steel tubes with internal corrosion-resistant nonmetallic coatings are intended for the transport of products with agressive properties. By construction/design such ducts and parts are two-layer, which consist of steel shell (duct) and internal lining layer which is linked with shell from within by different methods. The majorities of union couplings and parts make by dismountable/release ones; therefore such conduits/manifolds consist of the set of separate parts with the previously prepared/prefabricated elements/cells of connections.

By the basic types of internal nonmetallic coatings are: rubberizing, lining plastics (polyethylene, polyvinyl chloride plastic, teflon), enamel. Furthermore, is used coating the internal surface of ducts and parts by glass and corrosion-resistant paints/colors.

The characteristic of ducts and parts of the conduits/manifolds with internal corrosion-resistant coatings, prepared with industry on all-Union, branch or factory standards, is given in Table 21.

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Table 21. Characteristic of steel tubes and parts of conduits/manifolds with internal anticorrosion coatings.

(1) Наименование труб и деталей трубопроводов	(2) ГОСТ, ТУ, нормаль		(3) Покрытие		(4) Пределы применения		(5) Размеры в мм		(6) Номер таблицы по данной главе
	(7) трубы	(8) детали трубопроводов	(9) материал	(10) толщина в мм	(11) рабочее давление $P_{раб}$ в кгс/см²	(12) температура продукта в °C	(13) условные проходы	(13a) длина труб	
					(14) не более				
(15) Гуммированные (футерованные резиной)	(16) По материалам ГПИ Гипрометаллургмонтаж		(17) Резина, эбонит	4,5	10	(18) От —30 до +30	40—400	300—3200	22—29
(19) Футерованные полиэтиленом	а) ГОСТ 10762—64	а) МН 5030-63— МН 5052-63	(20) Полиэтилен	1—4,5	16	(18) От —40 до +70	40—150	1000—8000	30—39
	б) ЧМТУ 3-271-69	б) ЧМТУ ВНИТИ 745-66; ЧМТУ ВНИТИ 744-66	(21) То же	2—5	16	(18) От 0 до +90	25—150	450—8000	40—45
(22) Футерованные винипластом	ГОСТ 10762-64	МН 5030-63— МН 5052-63	(23) Винипласт	1—4,5	16	(18) От —10 до +80	40—150	1000—8000	30—39
(24) Футерованные фторопластом	ВТУ 50-48-65		(25) Фторопласт-4	2,5—10	6	(18) От —195 до +250	50—300	1500—1800	46; 47
(26) Футерованные эмалью	(27) Нормали Смелянского машиностроительного завода		(28) Стеклоэмаль	0,4—1,5	6	(18) От 0 до +200	80—80	100—2000	48—52

Key: (1). Designation of ducts and parts of conduits/manifolds. (2). GOST, TU standard. (3). Coating. (4). Limits of use/application. (5). Sizes/dimensions in mm. (6). Number of table on this chapter. (7). duct. (8). part of conduits/manifolds. (9). material. (10). thickness in mm. (11). operating pressure $P_{раб}$ in kg/cm². (12). temperature of

product in °C. (13). internal diameters. (13a). the length of ducts. (14). it is not more. (15). Rubberized (lined by rubber). (16). Based on materials GPI of Giprometallurgmontazh. (17). Rubber, ebonite. (18). From ... to .... (19). Lined by polyethylene. (20). Polyethylene. (21). Same. (22). Lined by polyvinyl chloride plastic. (23). Polyvinyl chloride plastic. (24). Lined by teflon. (25). Teflon. (26). Lined by enamel. (27). Standards of Smela Machine Building Plant. (28). Glass enamel.

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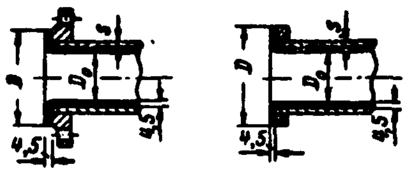
2. Ducts and parts of conduits/manifolds, lined by rubber[1] (rubberized).

FOOTNOTE 1. Is comprised on the standards of machine-building to the parts of conduits/manifolds, lined by rubber, MN 5760-65 - MN 5770-65, according to the nomenclature of the parts of conduits/manifolds - MSN 120-69/MMSS USSR, according to GOST 1256-67*, 1268-67* and 12830-67* , and also on standards to the rectilinear units of conduits/manifolds, lined by rubber, developed by GPI Giprometallurgmontazh. ENDFOOTNOTE.

Table 22. The coupling dies of the lined ducts and parts of conduits/manifolds in mm.



(1) P_y в кгс/см²	D_y	D	D_0									
			(2) Толщина стенки трубы или детали S									
			2,5	3,5	4	4,5	5	7	8	9	10	11
6 / 10	40	80 / 88	31	—	—	—	—	—	—	—	—	—
6 / 10	50	90 / 102	—	41	—	—	—	—	—	—	—	—
6 / 10	65	110 / 122	—	60	—	—	—	—	—	—	—	—
6 / 10	80	128 / 138	—	71	—	—	—	—	—	—	—	—
6 / 10	100	148 / 158	—	—	91	—	89	—	—	—	—	—
6	125	178	—	—	116	—	114	—	—	—	—	—

Continuation Table 22.

P_y в кгс/см² (1)	D_y	D	$D_н$ (2) Толщина стенки трубы или детали S									
			2,5	3,5	4	4,5	5	7	8	9	10	11
10	125	188	—	—	116	—	114	—	—	—	—	—
6	150	202	—	—	—	141	—	—	—	—	—	—
10		212										
6	200	258	—	—	—	—	—	196	194	—	—	—
10		268										
6	250	312	—	—	—	—	—	250	248	246	—	—
10		320										
6	300	365	—	—	—	—	—	—	300	298	296	—
10		370										
6	350	415	—	—	—	—	—	—	—	350	348	—
10		430										
6	400	465	—	—	—	—	—	—	—	399	397	395
10		482										

Key: (1). in kg/cm². (2). Wall thickness of duct or part S.

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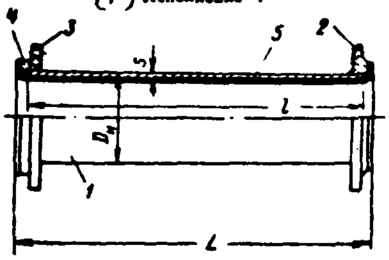
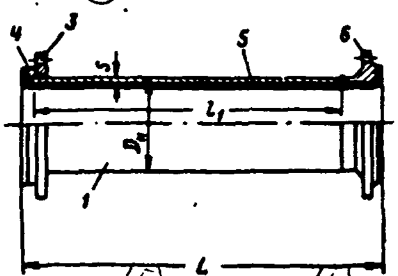
Table 23. Ducts steel, lined by rubber, on $P_y = 6$ and 10 kg/cm² (sizes/dimensions in mm, mass in kg.).

(1) Исполнение 1



(1) Исполнение 2



(2) 1 — труба; (3) 2 — фланец плоский приварной; (4) 3 — фланец свободный; (5) 4 — приварное кольцо; (6) 5 — гуммировка; (7) 6 — фланец приварной встык

(8) P_y, кгс/см²	D_y	$D_н$	S	L = 200				300				500				700			
				l	l_1	$F_г$, м²	(9) масса	l	l_1	$F_г$, м²	(9) масса	l	l_1	$F_г$, м²	(9) масса	l	l_1	$F_г$, м²	(9) масса
6	40	45	2,5	183	148	0,03	2,94	283	248	0,04	3,08	483	448	0,07	3,5	683	648	0,1	3,83
10					141		4,77		241		5,07		441		5,73		641		6,39
6	50	57			148	0,04	3,89		248	0,06	4,44		448	0,09	5,88		648	0,12	6,63
10	50	57	3,5	183	141	0,04	6,08	283	241	0,06	6,63	483	441	0,09	7,72	683	641	0,12	8,82
6	65	76		181	147	0,06	5,24	281	247	0,08	5,98	481	447	0,12	7,47	681	647	0,17	8,96
10					137		8,2		237		9		437		10,5		637		12
6	80	89			145	0,07	7,01		245	0,09	7,88		445	0,15	9,64		645	0,2	11,4
10					135		9,9		235		10,1		435		12,5		635		14,3
6	100	108	4		143	0,08	8,54		243	0,11	9,74		443	0,18	12,1		643	0,24	14,5
10					133		12,3		233		13,5		433		15,9		633		18,3
6	125	133	4		141	0,1	11		241	0,14	12,4		441	0,22	15,4		641	0,3	18,4
10					124		16,5		224		18		424		21		624		23,9
6	150	159	4,5		138	0,12	13,6		238	0,17	15,6		438	0,26	19,5		638	0,35	23,5
10					124		20,3		224		22,3		424		26,2		624		30,2
6	200	219	7	177	129	0,17	20,9	277	229	0,23	25	477	429	0,36	33	677	629	0,49	41
10					121		28,1		221		32,1		421		40,1		621		48,1

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Continuation Table 23.

6	250	273	8	173	127	0,2	28,1	273	227	0,29	33,7	473	427	0,45	45,1	673	627	0,61	55,4
10					117		36,9		217		42,9		417		54,3		617		65,6
6	300	325			126	0,25	37,6		226	0,34	44,4		426	0,54	58		626	0,73	71,5
10					116		44,6		216		51,3		416		65		616		78,5
6	350	377	9	171	125	0,27	47,5	271	225	0,39	56,3	471	425	0,61	73,8	671	625	0,85	91,4
10					115	0,29	58		215	0,41	66,8		415	0,63	84,4		615	0,87	101,9
6	400	426	10		125	0,31	59,3		225	0,44	70,2		425	0,7	92,1		625	0,95	114
10					115	0,34	77,1		215	0,47	88,1		415	0,73	110		615	[illegible]	131,9

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P_y, кгс/см²	D_y	L = 1000: l	l_1	F, м²	масса	L = 1600: l	l_1	F, м²	масса	L = 2000: l	l_1	F, м²	масса	L = 3200: l	l_1	F, м²	масса
6	40	983	948	0,13	4,42	1583	1548	0,21	7,77	1983	1948	0,26	7,35	3183	3148	0,41	13
10			941		7,38		1541		9,35		1941		10,7		3141		14,6
6	50		948	0,17	8,3		1548	0,26	11,5		1948	0,32	13,8		3148	0,51	20,3
10			941		10,5		1541		13,7		1941		15,9		3141		22,5
6	65	981	947	0,23	11,2	1581	1547	0,36	15,6	1981	1947	0,45	18,6	3181	3147	0,7	27,5
10			937		14,2		1537		18,7		1937		21,6		3137		30,5
6	80		945	0,27	13,9		1545	0,43	19,3		1945	0,57	22,8		3145	0,94	33,3
10			935		16,9		1535		22,1		1935		25,7		3135		36
6	100		943	0,33	18,1		1543	0,52	25,1		1943	0,65	30,1		3143	1,02	44,4
10			933		21,8		1533		29		1933		33,9		3133		48,1
6	125		941	0,42	22,8		1541	0,65	31,7		1941	0,81	37,7		3141	1,28	55,5
10			924		28,4		1524		37,3		1924		43,2		3124		61
6	150		938	0,5	29,4		1538	0,78	41,2		1938	0,97	48,1		3138	1,54	72,7
10			924		36,1		1524		47,9		1924		56,8		3124		79,4

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Continuation Table 23.

6	200	977	929	0,68	53	1577	1529	1,07	77	1977	1929	1,32	93,1	3177	3129	2,1	141,2
10			921		60,1		1521		84,2		1921		100,2		3121		148,3
6	250	973	927	0,85	73,4	1573	1527	1,33	107,3	1973	1926	1,66	130	3173	3127	2,63	197,7
10			917		82,6		1517		116,6		1917		139,2		3117		207,1
6	300		926	1,02	91,9		1526	1,6	122,5		1926	1,99	159,6		3126	3,16	241
10			916		96,8		1516		139,5		1916		166,6		3116		248
6	350	971	925	1,18	117,7	1571	1525	1,85	170,4	1971	1925	2,3	205,5	3171	3125	3,66	310,8
10			915	1,2	128,2		1515	1,87	180,9		1915	2,32	216		3115	3,68	321,3
6	400		925	1,33	146,9		1525	2,1	212,5		1925	2,61	256,3		3125	4,14	387,7
10			915	1,36	164,7		1515	2,14	230,4		1915	2,64	274,2		3115	4,17	405,6

Notes: 1. Steel shell - from ducts according to GOST 8732-70 and GOST 8734-58**.

2. Flanges for ducts of performance 1 - according to GOST 1255-67* and GOST 1268-67*, performance by 2 - according to GOST 12830-67* and GOST 1268-67*.

3. Coupling dies see in Table 22.

4. Material of gumming - rubber on TU 38-5-815-67. F_r - conventional designations of the surface of gumming.

Key: (1). Performance. (2). duct. (3). flange flat/plane welded. (4). flange (free.) (5). welded ring. (6). gumming. (7). flange of welded butt. (8). kg/cm². (9). mass.

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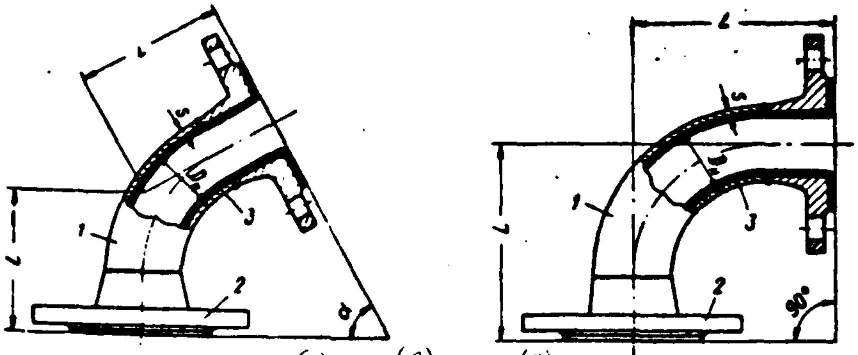
Table 24. Offtakes steel, lined by rubber, on P_y=6 and 10 kg/cm² (sizes/dimensions in mm, mass in kg.).



(1) (2) (3)
1 — отвод; 2 — фланец; 3 — гуммировка

(4) P_y, кгс/см²	D_y	S	L, 45	L, 60	L, 90	$F_г$, м², 45	$F_г$, м², 60	$F_г$, м², 90	(5) Масса, 45	Масса, 60	Масса, 90
			(6) отводов под углом α в град								
6	40	2,5	70	80	104	0,02	0,02	0,02	2,97	3,07	3,17
10			76	86	110		0,03	0,03	3,91	4,06	4,16
6	50	3,5	74	87	120	0,03	0,03	0,03	3,57	3,67	3,83
10			80	94	126			0,04	5,03	5,13	5,29
6	65		87	105	150	0,04	0,04	0,05	4,76	4,96	5,31
10			97	115	160	0,05	0,05	0,06	7,21	7,41	7,76
6	80		96	115	166		0,06	0,07	6,61	6,96	7,42
10			106	125	176	0,06	0,07	0,08	8,46	8,84	9,29
6	100	4	110	135	198				8,36	8,82	9,67
10			120	145	208	0,07	0,08	0,09	11,1	11,7	12,4
6	125		130	160	240	0,09	0,10	0,12	11,9	12,5	14
10			146	177	267	0,11	0,12	0,14	16,1	16,8	18,2

(4) P_y, кгс/см²	D_y	S	L, 45	L, 60	L, 90	$F_г$, м², 45	$F_г$, м², 60	$F_г$, м², 90	(5) Масса, 45	Масса, 60	Масса, 90
			(6) отводов под углом α в град								
6	150	4,5	146	183	278	0,11	0,12	0,15	14,6	15,6	17,9
10			160	197	292	0,13	0,14	0,17	20,3	21,5	23,7
6	200	7	184	233	360	0,18	0,21	0,26	25,8	28,5	33,6
10			192	240	368	0,2	0,22	0,27	31,8	34,5	39,6
6	250		215	277	435	0,26	0,3	0,38	37,9	42,6	52
10			225	287	445	0,28	0,31	0,39	45,3	49,9	59,4
6	300	8	247	320	510	0,34	0,4	0,51	55	62,7	78
10			257	330	520	0,36	0,41	0,52	63,8	70,5	85,8
6	350	10	278	364	586	0,43	0,5	0,66	78,7	89,6	115,2
10			[illegible]	374	596	0,46	0,53	0,69	89,4	102,3	128
6	400	9	310	407	660	0,53	0,63	0,82	90,2	106,3	136,4
10			[illegible]	417	670	0,55	0,66	0,86	100,2	124,2	154,4

Notes: 1. Offtakes - on MSN 120-69/MMSS USSR.

2. $D_{\text{н}}$ - see in Table 23.

3. Flanges - according to GOST 12830-67*.

Key: (1). offtake. (2). flange. (3). gumming. (4). kg/cm². (5). Mass. (6). offtakes at angle α in deg.

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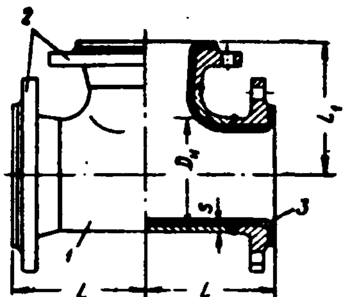
Table 25. T-connections tne steel equal flow, lined by rubber, on $P_y=6$ and 10 kg/cm².



(1) (2) (3)
1 — тройник; 2 — фланец; 3 — гуммировка

(4) P_y, кгс/см²	(5) Размеры в мм D_y	S	L	L_1	$F_г$, м²	(6) Масса в кг	(5) Размеры в мм D_y	S	L	L_1	$F_г$, м²	(6) Масса в кг
6	40	2,5	84	84	0,04	4,65	150	4,5	183	183	0,22	22,7
10			90	90		6,07			197	197	0,25	31,3
6	50	3,5	94	94	0,05	5,44	200	7	220	200	0,35	43,6
10			100	100		7,63			228	208	0,38	52,7
6	65		114	114	0,07	7,54	250	8	250	235	0,48	57,3
10			121	124	0,08	11,2			260	245	0,5	68,3
6	80		120	120	0,09	10,2	300	10	300	280	0,64	90,4
10			130	130	0,1	13			310	290	0,67	102,1
6	100	5	138	138	0,12	13,4	350	12	300	280	0,86	115,7
10			148	148	0,14	17,6			310	290	0,89	134,8
6	125	4	160	160	0,17	18,4						
10			177	177	0,19	24,6						

Notes: 1. T-connections - on MSN 120-69/MMSS USSR.

2. D_y - see in Table 23.

3. Flanges - according to GOST 12830-67*.

Key: (1). T-connection. (2). flange. (3). rubberizing. (4). kg/cm². (5). Sizes/dimensions in mm. (6). Mass in kg.

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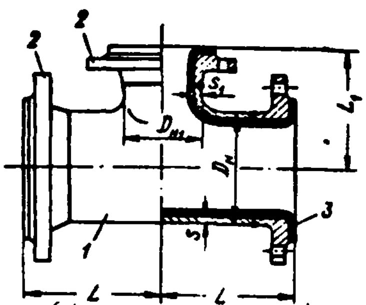
Table 26. T-connections the steel transitional, lined by rubber, on $P_y = 6$ and 10 kg/cm².



(1) (2) (3)
1 — тройник; 2 — фланец; 3 — гуммировка

(1) P_y, кгс/см²	(5) Размеры в мм $D_y \times d_y$	S	S_1	L	L_1	$F_г$, м²	(6) Масса в кг	(5) Размеры в мм $D_y \times d_y$	S	S_1	L	L_1	$F_г$, м²	(6) Масса в кг
6	50×40	3,5	2,5	94	90	0,06	5,31	150×100	4,5	4	183	163	0,25	20,4
10				100	96	0,07	7,3				197	173	0,27	27,5
6	65×40			114	104		6,7	150×125			183	170		21,9
10				124	110	0,08	9,62				197	187	0,3	29,7
6	65×50	3,5	3,5	114	110	0,08	7,03	200×125	7	4	220	190	0,4	35,9
10				124	116	0,09	10,2				228	207	0,43	44,2
6	80×50			120	110		8,79	200×150		4,5	220	203		36,9
10				130	116	0,1	11,2				228	217	0,46	45,8
6	80×65			120	114		9,4	250×150	8		250	233	0,56	39
10				130	124	0,11	12,4				260	247	0,59	49,3
6	100×65	5	4	138		0,12	11,9	250×200		7	250	240	0,65	53
10				148	134	0,14	15,9				260	248	0,67	63,4
6	100×80	4	3,5	138	130		12,4	300×200	10		300	265	0,81	82
10				148	140	0,15	16,1				310	273	0,83	92,8
6	125×80			160		0,18	16,2	300×250		8	300	270	0,91	85,3
10				177	160	0,2	21,3				310	280	0,93	96,8
6	125×100		4	160	148	0,21	17,1	350×300	12	10	300	286	1,16	113,5
10				177	160	0,22	22,6				310	296	1,2	130,2

Notes: 1. T-connections - on MSN '120-69/MMSS USSR.

2. $D_н$ - see in Table 23.

3. Flanges according to GOST 12830-67*.

Key: (1). T-connection. (2). flange. (3). gumming. (4). kg/cm^2. (5). Sizes/dimensions in mm. (6). Mass in kg.

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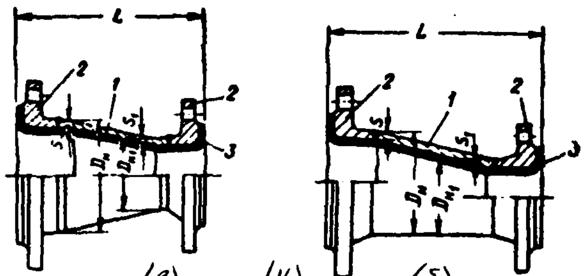
Table 27. Transitions steel, lined by rubber, on P_y=6 and 10 kg/cm².

(1) Концентрический (2) Эксцентрический



(3) 1 — переход; (4) 2 — фланец; (5) 3 — гуммировка

(6) P_y, кгс/см²	(7) Размеры в мм $D_y \times d_y$	S	S_1	L	F_r, м²	(8) Масса в кг	(7) Размеры в мм $D_y \times d_y$	S	S_1	L	F_r, м²	(8) Масса в кг
6	50×40	3,5	2,5	148	0,03	3,3	200×125*	7	4	250	0,18	18,7
10				162		4,5				275	0,19	23,8
6	65×40*			158	0,04	4,02	200×150*		4,5	253		19,7
10				175		5,69				275	0,21	25,6
6	65×50		3,5	158		4,2	250×150			293	0,24	25,8
10				175		6,18				317	0,26	32,1
6	—			—	0,05	—	250×200		7	280		28,6
10										300	0,28	35,2
6	80×50			165		5,15	300×200**	10	8		0,32	38,3
10				182		6,79				320	0,34	46,3

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Continuation Table 27.

(6) P_y, кгс/см²	(7) Размеры в мм $D_y \times d_y$	S	S_1	L	F_r, м²	(8) Масса в кг	(7) Размеры в мм $D_y \times d_y$	S	S_1	L	F_r, м²	(8) Масса в кг
6	80×65	3,5		165	0,06	5,66	300×200**	10		300	0,33	38,3
10				185		7,77			7	320	0,35	45,3
6	—			—		—	300×250*	9		300	0,36	40,9
10										320	0,37	48,1
6	100×65			172	0,08	6,67	300×250**		9	300	0,34	42,1
10				192		9,22				320	0,35	49,6
6	100×80			174		7,57	350×200*		8	420	0,42	49,4
10		4	3,5	194	0,09	9,89		10		440	0,45	58,8
6	—			—	—	—	350×250		9	420	0,47	56,2
10										440	0,49	66,2
6	125×80*			196	0,1	9,21	350×300		10	422	0,5	62
10				223	0,11	12,2				442	0,55	72,5
6	125×100*	5	5	198	0,1	10,2	400×250*		7	470		57,5
10				225	0,12	13,7		7		490	0,58	70,7
6	125×100**	4	4	198	0,1	10,1	400×300*		6	472	0,57	62,9
10				225	0,12	13,6				492	0,62	76,4
6	—	—	—	—	—	—	400×300**	11	10	472	0,5	75,4
10										492	0,55	88,9
6	150×100			230	0,11	11,5	400×350	11	10	472	0,63	80,9
10		4,5	4	255	0,13	15,8				492	0,66	96,8
6	150×125			233	0,12	13,2	—	—	—	—	—	—
10				264	0,14	18,3						

Note: 1. Transitions - on MSN 120-69/MMSS USSR.

2. $D_н$ - see in Table 23.

3. Flanges - according to GOST 12830-67*.

Key: (1). Concentric. (2). Eccentric. (3). transition. (4). flange. (5). gumming. (6). kg/cm². (7). Sizes/dimensions in mm. (8). Mass in kg.

FOOTNOTE [1]. Are produced only concentric transitions.

[2]. Are produced only eccentric transitions. ENDFOOTNOTE.

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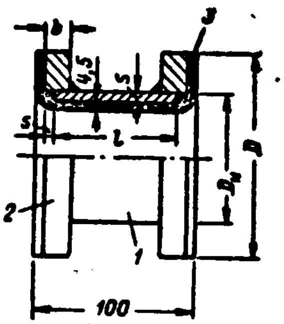
Table 28. Inserts steel L=100 mm, lined by rubber, on P_y=6 and 10 kg/cm².



(1) (2) (3)
1 — труба, 2 — приварное кольцо, 3 — гуммировка

(4) P_y, кгс/см²	(5) Размеры в мм D_y	l	D	b	$F_г$, м²	(6) Масса в кг	(5) Размеры в мм D_y	l	D	b	$F_г$, м²	(6) Масса в кг
6	40	83	80	10	0,02	1,02	150	80	202	16	0,07	5,07
10			88	12		1,33			212	18		6,48
6	50		90			1,28	200	77	258		0,11	8,11
10			102	14		1,81			268	20		9,92
6	65	80	110		0,04	1,94	250	73	312	18		10,3
10			122	16		2,67			320	22		12,8
6	80		128	14	0,05	2,54	300		365	20	0,16	14,4
10			138	16		3,32			370	22		16,1
6	100		148	14		3	360	70	415	20		16,4
10			158	16		3,88			430	24	0,17	21,7
6	125		178	14	0,06	3,97	400		465		0,18	21,3
10			188	18		5,40			482	26	0,21	27,4

Notes: 1. Duct - according to GOST 8732-70 and GOST 8734-58**

$D_н$ and S - see in Table 23.

2. Welded rings - according to GOST 1268-67* (see Chapter IV).

Key: (1). duct. (2). welded ring. (3). rubberizing. (4). kg/cm². (5). Sizes/dimensions in mm. (6). Mass in kg.

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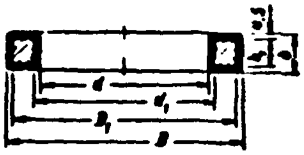
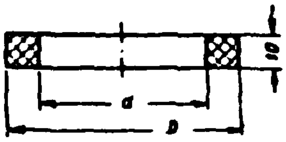
Table 29.

Rings on P_y = 6 and 10 kg/cm².

(1) Футерованные резиной



(2) Резиновое



(3) P_y, кгс/см²	(4) Размеры в мм D_y	D	D_1	d	d_1	(5) Масса в кг (6) гуммированного кольца $b=20$, $b_1=11$	$b=30$, $b_1=21$	$b=40$, $b_1=31$	(7) резинового кольца
6	40	80	71	29	37	0,32	0,56	0,81	0,05
10		88	79			0,41	0,73	1,05	0,07
6	50	90	81	41	50	0,35	0,63	0,9	0,06
10		102	93			0,52	0,92	1,32	0,08
6	65	110	101	59	68	0,48	0,86	1,23	
10		122	113			0,68	1,22	1,75	0,11
6	80	128	119	71	80	0,66	1,17	1,68	
10		138	129			0,85	1,52	2,19	0,13
6	100	148	139	91	100	0,79	1,41	2,02	
10		158	149			1,02	1,84	2,6	0,16

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Continuation Table 29.

6	125	158	149	116	125	1,09	1,93	2,70	0,17
10		188	179			1,36	2,42	3,46	0,21
6	150	202	193	141	150	1,24	2,21	3,18	0,2
10		212	203			1,55	2,76	3,97	0,24
6	200	258	249	196	205	1,68	2,99	4,29	0,27
10		268	259			2,07	3,69	5,31	0,32
6	250	312	303	250	259	2,08	3,7	5,32	0,33
10		320	311			2,45	4,38	6,3	0,38
6	300	365	356	298	307	2,7	4,82	6,94	0,42
10		368	359			2,9	5,16	7,65	0,46
6	350	415	406	350	359	3	5,36	7,69	0,47
10		428	419			3,86	6,88	10,2	0,59
6	400	465	456	397	406	3,62	6,38	9,18	0,55
10		482	473			4,79	8,57	12,4	0,7

Notes: 1. Material of ring - steel of brands 10; 15 and 20 (GOST 1050-60*).

2. Material of gumming and rubber ring - see note to Table 23.

Key: (1). lined with rubber. (2). rubber. (3). kg/cm². (4). Sizes/dimensions in mm. (5). Mass in kg. (6). rubberized ring. (7). rubber ring.

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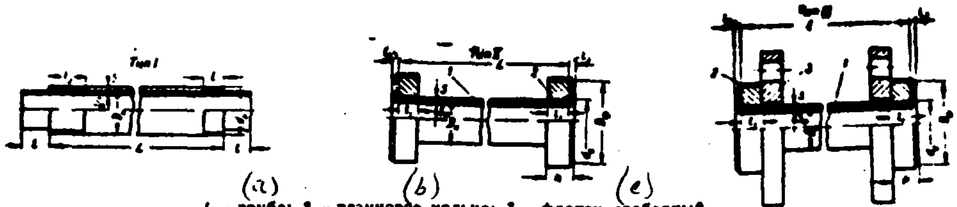
Table 30. 3. Ducts and parts of conduits/manifolds, lined by polyvinyl chloride plastic and polyethylene. Ducts steel, lined by polyvinyl chloride plastic and by polyethylene (GOST 10762-64).



(a) (b) (c)

1 — труба; 2 — резиновое кольцо; 3 — фланец свободный

(1) Тип трубы	(2) Размеры в мм											(3) Масса в кг 1 пог. м труб., футерованных	
	D_y	$D_н$	S	$S_ф$	l	(4) резьба d_0	l_1	l_2	l_3	h	$D_ф$	(5) винипластом	(6) полиэтиленом
I	40	45	2	2	(7) От 80 до 100	M45×1,5	22	60	—	—	—	2,43	2,33
II, III								—	5	22	78		
I	50	56/57	2,5/3	2		M56×2	28	74	—	—	—	3,73/4,43	3,58/4,28
II, III							24	—	6	24	90		
I	65	75,5	4	2,5		(8) Труб 2 1/2"	36	92	—	—	—	7,81	7,55
II, III							26	—	7	27,5	110		
I	80	88,5	4	3		» 3"	36	92	—	—	—	9,36	9,01
II, III							28	—	7,5	31	122		
I	100	114				» 4"	46	116	—	—	—	12,2	11,74
II, III							32	—	9	36	140		

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Continuation table 30.

I	125	140	4,5	4	7 От 80 до 100	8 Труб	5"	80	120	—	—	—	17,27	16,51
II III								34	—	10	38	168		
I	180	165	4,5	4,5		»	6"	54	140	—	—	—	30,47	19,56
II III								34	—	12,5	40,5	192		

Notes: 1. Length of ducts L to 8 m.

2. Thread at ends of ducts: D_y to 50 mm - metric (GOST 9150-59*); D_y is more than 50 mm - tube cylindrical (GOST 6357-52).

3. Tolerances for thread according to plain grade of fit (GOST 9253-59).

4. Union couplings of type I make either by flanged ones or threading ones (on couplings). Union couplings of the type II make on half-flanges on MN 5034-63, while those of the type III - on slip-on

flanges according to GOST 10762-64; the types of connections of ducts and parts of the conduits/manifolds, lined by polyvinyl chloride plastic and polyethylene. - see chapter XIV.

5. Steel shell - from ducts according to GOST 8732-70, 8734-58**, 10704-63*, 10707-63 and 3262-62. Rings threading and flanges - see Table 31 and 32.

6. As lining layer use ducts forcing from polyvinyl chloride plastic on basis of polyvinylchloride resin PF-4, from low-density polyethylene of brand P2006- V and high-density polyethylene brand P4004-0.

Key: (a). duct. (b). rubber ring. (c). flange (free. (1). Type of duct. (2). Sizes/dimensions in mm. (3). Mass in kg. 1 lin. m of ducts., lined. (4). thread. (5). PVC. (6). by polyethylene. (7). From 80 to 100. (8). Ducts.

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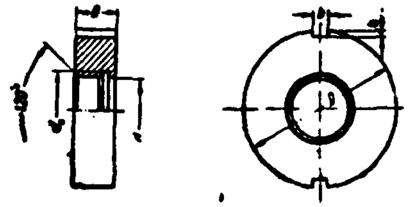
The ends of the steel shell and lining layer must be cut off at right angle to the axis/axle of duct and cleaned from barbs. The ends of the lining layer must not have strains and cuts.

Ring screw-threads gauge must be covered to support into the end/face of duct. Flanging of the lining layer must fit face of ring screw-thread gauge. The surface of flanging must not have gas inclusions, barbs, radial folds and strains.

The internal surface of the lining layer and the external surface of its protruding ends must be smooth, without cracks, gas inclusions and bulgings. The protruding ends of the lining layer and the thread of steel shell must be shielded from mechanical damages.

Table 31. Rings threading on P_y=10 and 16 kg/cm² (GOST 10762-64).



(1) Размеры в мм							(2) Масса в кг
D_y	D	d	d_0	B	b	h	
40	88	41	M45×1,5	20	7	3	0,73
50	102	51	M56×2"	22	9	4	1
65	122	69	(3) Труб 2 ½	25			1,49
80	138	81	» 3"	28	12		1,91
100	158	106	» 4"	32		6	2,9
125	188	131	» 5"	34	15		4,24
150	212	156	» 6"	36			5,06

Notes: 1. Material - steel of brand 35 (GOST 1050-60**) or St. 4 (GOST 380-71).

2. Thread of rings D_y= 40 and 50 mm - metric (GOST 9150-50*); D_y is more than 50 mm - tube cylindrical (GOST 6357-52).

3. Tolerances for thread - according to plain grade of fit (GOST 9253-59).

Key: (1). Sizes/dimensions in mm. (2). Mass in kg. (3). Ducts.

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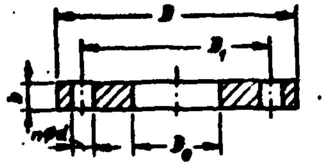
Table 32. Flanges steel free on $P_y = 10$ and 16 kg/cm² (GOST 10762-64).



(1) Размеры в мм					(2) Отверстия		(4) Масса в кг
D_y	D	D_1	D_0	b	d, мм	(3) количество шт.	
40	145	110	48	20	18	4	2,15
50	160	125	60				2,55
65	180	145	80	22			3,35
80	195	160	93	21		8	3,95
100	215	180	120	26			5
125	245	210	145	[illegible]			6,65
150	[illegible]	[illegible]	170		23		8,15

Note. Material - steel of brands St. 4sp and St. 5 sp (GOST 380-71).

Key: (1). Sizes/dimensions in mm. (2). Holes. (3). Quantity pieces. (4). Mass in kg.

Table 33. Enumeration of the standardized parts of conduits/manifolds, lined by polyvinyl chloride plastic and polyethylene, on P_y =10 and 16 kg/cm² (placed in handbook).

(1) Наименование	D_y, мм	(2) P_y, кгс/см²	(3) Номер нормали	(4) № таблицы
(5) Полуфланцы	40—150	10; 16	МН 5034-63	34
(6) Втулки буртовые:				
(7) винипластовые	40—150	—	МН 5035-63	35
(8) полиэтиленовые	40—150	—	МН 5036-63	36
(9) Отводы фланцевые под углом:				
90°	40—150	10; 16	МН 5038-63	37
45°	40—150	10; 16	МН 5039-63	37
30°	40—150	10; 16	МН 5040-63	37
(10) Тройники фланцевые:				
(11) равнопроходные	40—150	10; 16	МН 5041-63	38
(12) переходные	40—150	10; 16	МН 5042-63	38
(13) Переходы концентрические фланцевые	40—150	10; 16	МН 5043-63	39

Notes: 1. The standards of machine-building are propagated to the poured pig iron and steel shaped parts to P_y=10 and 16 kg/cm², lined by polyvinyl chloride plastic and polyethylene, intended for the assembly of conduits/manifolds from the lined ducts according to GOST 10762-64, which transport the products in which polyvinyl chloride plastic and polyethylene of strut.

2. Material of housings of shaped flanged parts on P_y=10 kg/cm² - gray cast iron of brand/mark is not below SCh18-36 (GOST 1412-70), on P_y=16 kg/cm² - steel of brand 20L (GOST 977-65*).

3. Material of half-flanges on P_y=10 kg/cm² - gray cast iron of brand/mark is not below SCh28-48 (GOST 1412-70); on P_y=16 kg/cm² -

steel of brand 20L (GOST 977-65*).

4. Technical requirements see in MN 5053-63.

Key: (1). Designation. (2). kg/cm². (3). Number of standard. (4). table. (5). Half-flanges. (6). Bushings bead. (7). polyvinyl chloride. (8). polyethylene. (9). Offtakes flanged at angle . (10). T-connections flanged. (11). equal-flow. (12). transitional. (13). Transitions concentric flanged.

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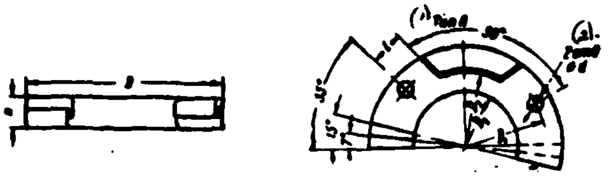
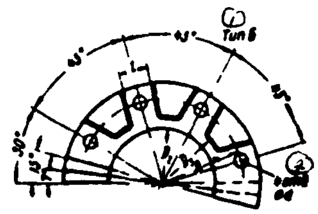
Table 34. Half-flanges on $P_y = 10$ and 16 kg/cm² (НН 5034-63).





(3) Тип полуфланца	(4) Размеры в мм					(5) Масса в кг
	D_y	$D_н$	D_1	H	l	
А	40	48	80	19	18	0,81
А	50	59	109	20	18	1
	65	78	128	22		1,4
	80	92	142	24	36	1,6
Б	100	116	166	26	40	2
	125	144	194	28		2,6
	150	168	218		44	3,6

Note. Sizes/dimensions D, D_1 and d - see in Table 36.

Key: (1). Type. (2). opening. (3). Type of half-flange. (4). Sizes/dimensions in mm. (5). Mass in kg.

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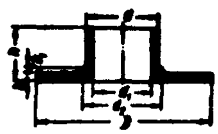
Table 35. Bushings bead polyvinyl chloride and polyethylene (НН 5035-63, НН 5036-63).



(1) Размеры в мм									(2) Масса 100 шт. втулок в кг	
D_y	D	d	d_1	d_2	(3) h втулки (4) винипластовой	(5) полиэтиленовой	b	b_1	(6) винипластовых	(7) полиэтиленовых
40	88	37	33	40	35	24	3,5	2,5	2,7	2,3
50	102	47	42	50	43	28		3	4,6	3
65	122	63	58	67	49	30	4	4	8,1	4
80	138	74	68	79	57	36			10,4	7
100	158	100	92	104	73	38	4,5		22	10
125	188	123	114	128	90	48	5	6	24	12
150	212	147	137	163	100	54	6		47	24

Key: (1). Sizes/dimensions in mm. (2). Mass 100 pieces of bushings in kg. (3). bushing. (4). polyvinyl chloride. (5). polyethylene. (6). polyvinyl chloride. (7). polyethylene.

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Table 36. The basic dimensions of the flanges of the castings, lined by polyvinyl chloride plastic and polyetLylene (see Fig. to table 37-39).

P_y	D_y (D'_y)	D (D')	D_1 (D'_1)	D_2 (D'_2)	D_3 (D'_3)	D_4 (D'_4)	b (b')	(2) d, mm	(3) quantity
	(1)								
10	40	145	110	88	78	42	16	18	4
16							18		
10	50	160	125	102	90	53	16		
16							20		
10	65	180	145	122	110	71	18		
16							20		
10	80	195	160	138	122	82			
16							22		
10	100	215	180	158	140	104	20		8
16							22		
10	125	245	210	188	168	129			
16							24		
10	150	280	240	212	192	[illegible]		22	
16									

Note. Sizes/dimensions with index (') - for transitional ones it is branch and transitions.

Key: (1). Sizes/dimensions in mm. (2). Holes. (3). Quantity.

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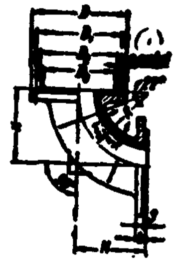
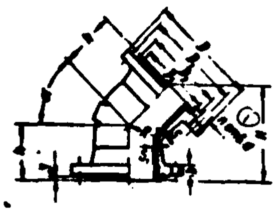
Table 37. Offtakes flanged at angle of 30, 45, 90°, lined by polyvinyl chloride plastic and polyethylene (MN 5040-63, MN 5039-63, MN 5038-63).





(2) Размеры в мм								(3) Масса детали в кг	
P_y	D_y	R: α=30° (4) и 45°	R: α=90°	H	h	S	S_1	α=30° (4) и 45°	α=90°
10	40	21	110	110	85	7	3	5,6	4,8
16								6	
10	50	26,5	120	120		7,5		7,4	5,1
16								7,9	
10	65	36,5	135	135	100		3,5	10	6,2
16								10,7	
10	80	41	145	145	110	9		13,3	7,9
16								14,2	
10	100	53	160	160			4,5	15,2	10,1
16								16,3	
10	125	64,5	180	180	120	10		22,13	16,6
16								23,85	
10	150	78	195	195				26,8	17,6
16								28,7	

Note. The sizes/dimensions of flanges see in Table 36.

Key: (1). opening. (2). Sizes/dimensions in mm. (3). Mass in part in kg. (4). and.

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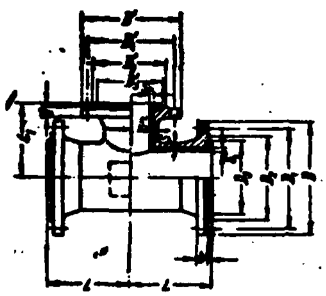
Table 38. T-connections flanged, lined by polyvinyl chloride plastic and polyethylene, on P_y=10 and 16 kg/cm² (MH 5041-63, MH 5042-63).



(1) Размеры в мм							(2) Масса детали в кг
$D_y \times D'_y$	L	L_1	S	S_1	S'	S'_1	
40×40	110	110	7		7		8,4
50×40	120			3			15,1
50×50		120			7,5	3	10,9
65×40		110	7,5		7		14,2
65×50	135	120			7,5		15,4
65×65		136		3,5			13,7
80×80	145	145			9		17,9
100×65		136			7,5		24
100×80	160	145	9		9	3,5	25,6
100×100		160				4,5	24,6
125×65		136		4,5	7,5	3,5	28,3
125×100	180	160			9		38
125×125		180			10		33,3
150×100		160			9	4,5	48,7
150×125	195	180	10		10		51,3
150×150		195					46,4

Note. The sizes/dimensions of flanges - see in Table 36.

Key: (1). sizes/dimensions in mm. (2). Mass of part in kg.

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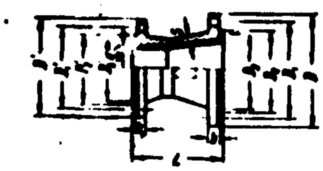
Table 39. Transitions the concentric flanged, lined by polyvinyl chloride plastic and polyethylene, on P_y = 10 and 16 kg/cm² (MN 5043-63).



(1) Размеры в мм				Масса детали в кг (2)
$D_y \times D'_y$	L	S	S_1	
50×40	140	7,5	3	6,7
65×40	150		3,5	7,5
65×50				8,4
100×50	180	9	4,5	12,6
100×65				13,6
100×80	200			15,1
125×65		10		17,1
125×100				19,2
150×100				23,4
150×125				24

Note. The sizes/dimensions of flanges see in Table 36.

Key: (1). Sizes/dimensions in mm. (2). Mass of part in kg.

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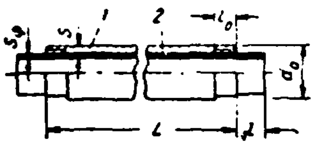
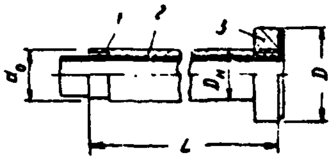
Table 40. Ducts are the steel, lined by high-density polyethylene (TSPH 3-271-69).

(1) Тип I



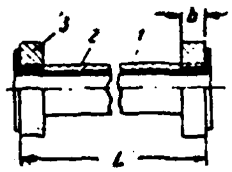
(2) 1 — труба;

(1) Тип II



(3) 2 — футеровка;

(1) Тип III



(4) 3 — резьбовое кольцо

(5) Размеры в мм									(7) Масса 1 пог. м (без колец) в кг
D_y	$D_н$	S	$S_ф$	l	(6) резьба d_0	(6) резьба l_0	D	b	
25	32	2,5	2	(8) От 100 (9) до 110	M32×1,5	18	40	15	1,94
32	40	2,5	2	(8) От 100 (9) до 110	M40×1,5	18	57	15	2,5
40	51	3	2	(8) От 100 (9) до 110	M51×1,5	18	68	15	3,8
50	56	3	2	(8) От 100 (9) до 110	M56×2,0	18	76	15	4,3

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80	90	5	3	От 100 до 110	M90×3	22	121	20	11
100	114				M114×3		140		14,3
125	140		4		M140×3	26	180	25	18,2
160	165	6			M165×3		212		24,4

Notes: 1. Ducts are intended for the transporting of media to which polyethylene of struts, with the temperatures: from 9 to 70°C at a pressure to 16 kg/cm²; from 0 to 80°C at a pressure to 10 kg/cm²; from 0 to 90°C at a pressure to 6 kg/cm².

2. Ducts are supplied measured length: 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000 mm, and also off-measure in limits from 1200 to 6500 mm.

Ducts in long to 1100 mm inclusively (bushings) are supplied the measured length: 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 900, 1000 and 1100 mm.

3. Union couplings of types I and II are fulfilled on slip-on flanges (see Table 44), and type III - on dismountable/release stamped/die-forged flanges (see Table 45).

4. Steel shell - from ducts according to GOST 8732-70 and GOST 8734-58**.

5. As lining layer are used ducts from high-density polyethylene on MRTU 6-05-917-67.

Key: (1). Type. (2). duct. (3). lining. (4). ring screw-thread gauge. (5). Sizes/dimensions in mm. (6). thread. (7). Mass of 1 lin. m (without rings) in kg. (8). From. (9). to.

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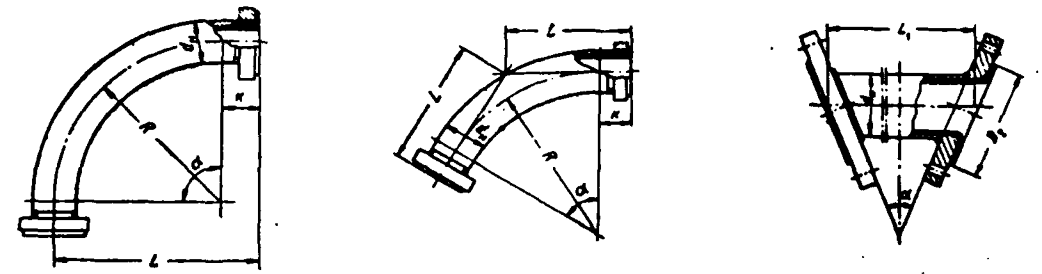
Table 41. Offtakes are the steel, lined by high-density polyethylene (ChNTU/VNITI 745-66) (sizes/dimensions in mm, mass in kg.).

(1) Отвод гнутый под углом 90° (1) Отвод гнутый под углом 30, 45 и 60° and (2) Отвод составной под углом 30 и 45°



D_y	$D_н$	R	K	L (4) для отводов под углом α: 30°	45°	60°	90°	L_1	D_1	(3) Масса: (5) гнутых отводов под углом α (без фланцев): 30°	45°	60°	90°	(6) составных отводов, P_y, кгс/см² (7): 6	10	16
25	32	130	150	185	204	225	280	300	54	0,71	0,77	0,84	0,97	2,03	2,31	2,59
32	40	160		193	216	242	310		64	0,95	1,05	1,16	1,37	2,74	3,48	3,86

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40	51	200.	180	252	277	300	400		72	2,31	2,51	2,71	2,46	3,2	4,62	5,06
50	56	280	200	275	316	362	480	200	84	2,77	3,08	3,39	4,01	3,86	5,4	5,92
80	89	445	300	420	485	557	745		126	9,1	10.38	11,7	14,2	7	9,74	10,4
100	114	455	350	472	539	612	805		146	13,3	15	16,7	20,1	7,92	11,5	12,3
125	140	—	—	—	—	—	—		180	—	—	—	—	9,86	15,2	16,1
150	165	—	—	—	—	—	—	225	210	—	—	—	—	14,3	20,1	21,2

Notes: 1. The limits of use/application - see note 1 to table 40.

2. Wall thickness of steel shell, lining layer and sizes/dimensions of ring screw-threads gauge - see Table 40* sizes/dimensions of flanges - see Table 44.

3. Composite/compound offtakes are produced with angle α=30 and 45°.

Key: (1). Offtake bent at angle. (2). Offtake of composite/compound at angle of 30 and 45°. (3). Mass. (4). for offtakes at angle. (5). bent offtakes at angle α (without flanges). (6). composite/compound offtakes. (7). kg/cm².

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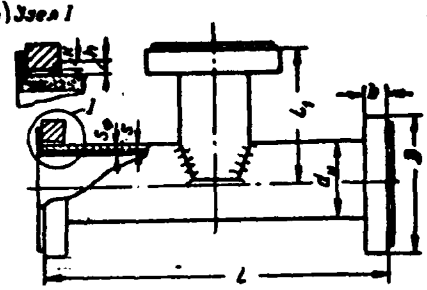
Table 42. T-connections are the steel, equal-flow, lined by high-density polyethylene (СЬЯТЦ/ЧНИТИ 744-66).

(1) Узел I



(2) Размеры в мм								(3) Масса в кг
D_y	$d_н$	S	$S_ф$	L	L_1	b	K	
25	38	3	3	180	100	4	3	1
32	45		2,5	200	115			1,38
40	53	4	2,5	230	120	5	4	2
50	60		2,9	265	150			2,35
80	89		4,3	330				8
100	111	5		350	200	6	5	10
125	146		4	400				20
150	168	6	4,5	450	225	7	6	30

Notes: 1. T-connections are intended for the conduits/manifolds, which transport media from P_y to 4 kg/cm² with t from 0 to +90°C.

2. Sizes/dimensions D and b - see Table 40.

3. Steel shell - from ducts according to GOST 8732-70 and 8734-58**, lining layer - see note by 5 to table 40. Performances of the lining layer - welded.

4. According to agreement with customer T-connections are produced with threading, welded rings or with welded flanges.

Key: (1). Unit. (2). Sizes/dimensions in mm. (3). Mass in kg.

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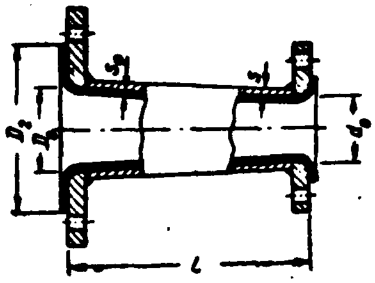
Table 43. Transitions steel, lined by polyethylene (based on materials of primary Ural old-tube plant).



(1) Размеры в мм					
$D_y \times d_y$	D_0	d_0	S	S_ϕ	L
80×50	79	50	5	3	160
100×80	104	79			
125×100	130	104		4	180
150×125	150	130	6		

Note. The sizes/dimensions of flanges see in Table 44; D_2 see in Table 41.

Key: (1). Sizes/dimensions in mm.

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Table 44. Flanges steel free for pipes, lined by polyethylene (based on materials of primary Ural old-tube plant).

(3) P_y, кгс/см²	(1) Размеры в мм D_y	D	D_1	D_2	b	(2) Отверстия d, мм	(4) количество, n	(5) Масса в кг
2,5; 6	25	115	85	34	12	14	4	0,82
10					14			0,96
16					16			1,1
2,5; 6	32	135	100	43	12	18	4	1,12
10					16			1,40
16					18			1,60
2,5; 6	40	145	110	54	12			1,32
10					18			1,88
16					20			2,15
2,5; 6	50	160	125	60	12			1,82
10					18			2,28
16					20			2,54
2,5; 6	80	195	160	93	14			2,4
10					22			3,77
16					24		8	4,11
2,5; 6	100	215	180	110	14		4	2,53
10					24		8	4,34
16					26			4,7

continuation Table 44.

2,5; 6					14			3,12
10	125	245	210	144	26	18	8	5,8
16					28			6,23
2,5; 6					16			4,61
10	150	280	240	168	26	23		7,5
16					28			8,09

The notes: 1. Material of flanges - steel of brand St. 3, St. 4 (GOST 380-71*).

2. See Fig. to table 32.

Key: (1). Sizes/dimensions in mm. (2). Holes. (3). kg/cm². (4). quantity. (5). Mass in kg.

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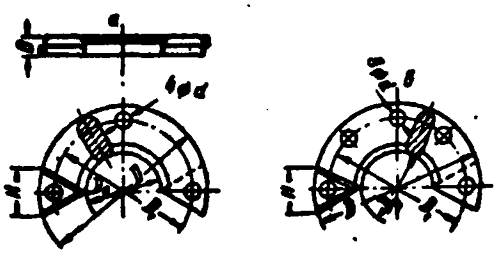
Table 45. Flanges dismcuntable/release stamped/die-forged for the conduits/manifolds, lined by polyethylene (based on materials of primary Ural old-tube plant).



(1) Размеры в мм			
D_y	H	B	
		P_y = 6 кг/см² (2)	P_y = 10 кг/см² (2)
25	36	16	18
32	43	16	18
40	43	16	18
50	48	16	18
80	43	18	20
100	48	18	22
125	48	20	24
150	48	20	24

Notes: 1. Sizes/dimensions D, D_1, D_0, d and quantity of bolt holes - see Table 44.

2. Material of flanges - steel of brand St. 3, St. 4 (GOST 380-71).

Key: (1). Sizes/dimensions in mm. (2). kg/cm².

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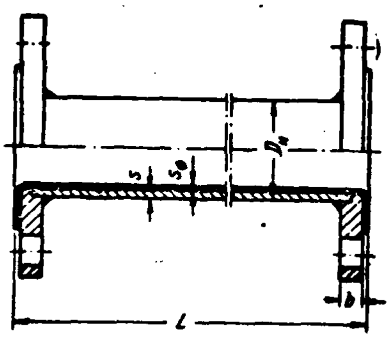
4. Ducts and parts of conduits/manifolds, lined by teflon.

The conduits/manifolds, lined by teflon, are intended for the transport of the agressive media (to which teflon of struts) without the limitation of concentrations at temperatures from -195 to +250°C and P_y to 6 kg/cm².

Table 46. Ducts steel, lined by teflon, on $P_y=6$ kg/cm² (DTS (Departmental Technical Specifications) 50-48-65).



(1) Размеры в мм						(2) Масса (без фланцев) в кг
D_y	$D_н$	S	$S_ф$	b	L	
50	57	3,5	3	14	(3) До 1800	5,6
65	76		4			7,7
80	89		5	16		10
100	108	4	6	16	(3) До 1800	14,1
125	133		7	18		18,4
150	159	4,5				24,2
200	219	7	8	20	(3) До 1700	47,5
250	273	8		22		66,1
300	325		10			83,3

Notes: 1. The coupling dies of flanges, diameters and quantity of bolt holes - according to GOST 1234-67*. $P_y=10$ kg/cm².

2. Ducts are produced indicated in order length.

3. As steel shells use ducts according to GOST 8732-70*; lining layer - teflon of brands A, B, C - according to GOST 10007-62*.

Key: (1). Sizes/dimensions in mm. (2). Mass (without flanges) in kg. (3). To.

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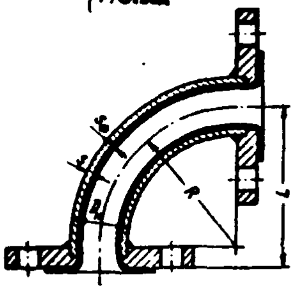
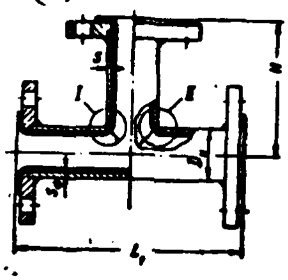
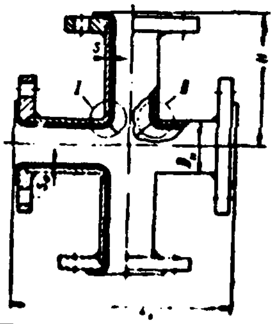
Table 47. Offtakes, T-connections and cross pieces, lined by teflon, on $P_y = 6$ kg/cm² DTS (Departmental Technical Specifications) 50-48-65).

(1) Отвод



(2) Тройник





(3) Крестовина

D_y	$D_н$	R	L	L_1	H
50	57	150	164	[illegible]	[illegible]
65	76	400	414	[illegible]	[illegible]
80	89	400	416	[illegible]	[illegible]
100	108	400	416	270	[illegible]
125	133	600	618	300	[illegible]
150	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
200	219	[illegible]	[illegible]	[illegible]	[illegible]
250	273	[illegible]	1112	[illegible]	[illegible]
300	325	1300	[illegible]	[illegible]	[illegible]

Notes: 1. The connecting sizes/dimensions of flanges, diameters and quantity of bolt holes - according to GOST 1234-67*, P_y-10 kg/cm²; b -

cm in Table 46.

2. T-connections and cross piece produce with welding of connecting pipe for D_y= 150-250 mm according to knot-type I; for D_y-300 mm - according to knot-type II; according to agreement with customer, T-connections and cross pieces of all D_y can be carried out with welding of connecting pipe according to knot-type II.

3. Steel shells and lining layer - see note by 3 to table 46; S and S_ϕ- see in Table 46.

Key: (1). Offtake. (2). T-connection. (3). Cross piece.

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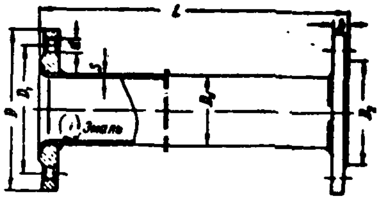
5. Ducts and part of enamelled conduits/manifolds (on standards of Smela Machine Building Plant).

Table 48. Enamelled ducts on $P_y = 6$ kg/cm².



(2) Размеры в мм			L, мм										
			100	150	200	250	300	400	500	750	1000	1500	2000
D_y	$D_н$	S	(3) Масса в кг										
50	60	3	3,13	3,34	3,55	3,76	3,97	4,4	4,82	5,87	6,92	9,04	11,14
65	75	4	4,08	4,43	4,78	5,13	5,48	6,18	6,88	8,63	10,38	13,88	17,38
80	90	4,5	5,96	6,44	6,9	7,4	7,86	8,8	9,76	12,13	14,5	19,3	24

Notes: 1. The sizes/dimensions of flanges see in Table 49.

2. Thickness of the layer of enamel 0.4-1.5 mm.

Key: (1). Enamel. (2). Sizes/dimensions in mm. (3). Mass in kg.

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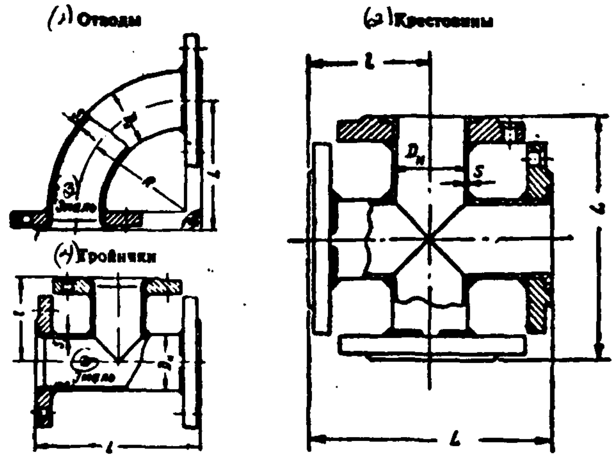
Table 49. Sizes/dimensions of the flanges of ducts and parts of the enamelled conduits/manifolds in mm.

D_y	D	D_1	D_2	b	(1) Отверстия	
					d	(2) количество
[illegible]	140	110	90	16	14	4
[illegible]	[illegible]	130	110			
[illegible]	[illegible]	[illegible]	[illegible]	18	18	

Key: (1). Holes. (2). quantity.

Table 50. Offtakes, T-connections and cross pieces enamelled on $P_y = 6$ kg/cm².



(5) Размеры в мм				L, мм		l, мм	(6) Масса в кг		
D_y	$D_н$	S	R	(7) отвода	(8) тройника и крестовины		(7) отвода	(9) тройника	(10) крестовины
50	60	3	120	140	200	100	3,06	5,06	7,13
65	75	4	150	170	230	115	5,31	7,40	9,46
80	90	4,5	200	200	260	125	9,3	10,64	14

Note. The sizes/dimensions of flanges - see Table 49.

Key: (1). offtakes. (2). Cross pieces. (3). Enamel. (4). T-connections. (5). Sizes/dimensions in mm. (6). Mass in kg. (7). offtake. (8). T-connection and cross piece. (9). T-connection. (10). cross piece.

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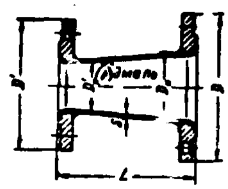
Table 51. Transitions enamelled on $P_y=6$ kg/cm².



(2) Размеры в мм								(3) Масса в кг
D_y	D'_y	$D_н$	$D'_н$	D	D'	S	L	
65	50	75	60	160	140	4	165	4,09
80	50	90	60	185	140	4,5	200	6
	65	90	75		160			6,4

Note. The sizes/dimensions of flanges - see in Table 49.

Key: (1). Enamel. (2). Sizes/dimensions in mm. (3). Mass in kg.

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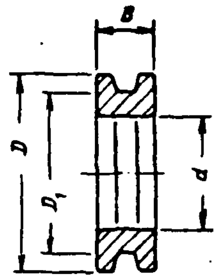
Table 52. Inserts enamelled on P_y=6 kg/cm².



(1) Размеры в мм					(2) Масса в кг
D_y	B	D	D_1	d	
50	20	96	78	55	0,64
	30				0,86

50	40	96	75	55	1,06
	50				1,32
65	20	116	95	70	0,80
	30				1,2
	40				1,53
	50				1,80
80	20	132	110	85	1,07
	30				1,47
	40				1,87
	50				2,32

Key: (1). Sizes/dimensions in mm. (2). Mass in kg.

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